Volume MRP-CB
incorp into MRP-CB
2/08

APPENDIX 3-11

Muddy Creek Technical Report

Wildlife

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

MUDDY CREEK TECHNICAL REPORT

WILDLIFE

1.0 INTRODUCTION

1.1 STATEMENT OF PROJECT OBJECTIVES

Passage of the Utah Schools and Lands Exchange Act of 1998 included the exchange of lands to resolve issues associated with creation of the Escalante-Grand Staircase National Monument. To balance land values exchanged under that act, the coal estates on several tracts of federal coal underlying the Manti-LaSal National Forest (MLNF) were conveyed to the State of Utah School and Institutional Trust Lands Administration (SITLA). This conveyance is temporal and the ownership of the coal will revert back to the federal government once a specific tonnage is produced or a specified royalty value is collected.

On the conveyed coal estates, SITLA has sole authority to lease the coal. Under the Surface Mine Control and Reclamation Act of 1977 and Utah Coal Rules, Forest Service must consent to the mine plan prior to mine development and can impose requirements for the protection of non-coal resources. The Forest Service decisions, as federal actions, are subject to the requirements of the National Environmental Policy Act of 1969 (NEPA), requiring environmental analysis and appropriate NEPA documents.

On the remaining federal coal estates within the Muddy Creek tract on National Forest System land, the U.S. Department of Interior, Bureau of Land Management (BLM) is the leasing authority. Under the Mineral Leasing Act of 1920, as amended by the Federal Coal Leasing Amendments Act of 1975, leases can only be issued by the BLM with consent from the Forest Service with conditions for protection of non-mineral resources. As federal actions subject to NEPA, both the BLM leasing decisions and the Forest Service consent decisions must be based on an environmental analysis and appropriate NEPA document.

This wildlife technical report is the result of three years of study of the Muddy Creek tract by Cirrus Ecological Solutions, LC (Cirrus), which included field studies, data acquisition, and data analyses and summaries. This technical report will form the basis for an analysis of impacts to wildlife in the project area in the subsequent Environmental Impact Statement (EIS) planned for the Muddy Creek tract on MLNF.

1.2 STATEMENT OF THE ISSUES WITH EVALUATION CRITERIA

The following wildlife issues and evaluation criteria were provided by the Forest Service in the scope of work for the Manti-LaSal Coal Tract Evaluations:

Wildlife Issue 1: Any changes in water flow and quality in perennial drainages and reservoirs or to riparian vegetation/wetlands could affect habitat for terrestrial and aquatic species.

Evaluation Criteria: Description of Potential Effect to Affected Habitat Amount and Quality.

Wildlife Issue 2: Subsidence of perennial streams could cause changes in stream morphology and aquatic habitat.

Evaluation Criteria: Description of changes to ratio of habitat types (pools, riffles, runs, glides, and cascades); changes in streambed sediments (spawning habitat); changes in bank stability.

Wildlife Issue 3: Exploration drilling and construction of mine vent holes could temporarily disrupt use of summer habitat by terrestrial species.

Evaluation Criteria: Area and Duration of Avoidance by Affected Species.

Wildlife Issue 4: Construction and operation of mine facilities and haul roads and coal traffic could remove habitat and associated noise/activity could displace dispersed wildlife (avoidance) including threatened, endangered, proposed and sensitive species.

Evaluation Criteria: Area of habitat removed or changed, type of habitat lost, duration of loss, area avoided, percent of available habitat effective habitat remaining, adequacy of remaining habitat to support wildlife populations.

1.3 DESCRIPTION OF THE ALTERNATIVES EVALUATED

1.3.1 Alternative 1 - No Action Alternative

Under the No Action Alternative, no mining would take place on the Muddy Creek tract. For this technical report, the No Action Alternative represents the baseline for estimating the effects of the action alternatives on wildlife in the project area. Further analysis of the No Action Alternative has been deferred until the EIS for this project is initiated.

1.3.2 Alternative 2 - Standard Lease Terms and Conditions

Under this alternative, the Muddy Creek tract would be leased and mined with BLM standard lease terms and conditions (USDI-BLM undated). No special coal lease stipulations would be included in the lease, and longwall mining would be allowed throughout the tract which could result in subsidence of perennial drainages, escarpments, and surface facilities. This alternative emphasizes maximum coal production assuming maximum economic production with no specific restrictions for protection of surface resources from the effects of subsidence and is expected to result in the greatest amount of environmental impact. A more complete description of Alternative 2 can be found in the Conceptual Mine Plan for the Muddy Creek Tract located in the Detailed Description of Alternatives.

1.3.3 Alternative 3 - Standard Lease Terms and Conditions and Special Stipulations

Under Alternative 3, the Muddy Creek tract would be leased and mined with BLM standard lease terms and conditions (USDI-BLM undated) and Manti-LaSal National Forest's special stipulations (Forest Service 2003a). This alternative emphasizes protection of surface resources. Subsidence of perennial streams, escarpments, and surface facilities would not be allowed. There would, however, be no specific prohibition on subsidence of roads, trails, or range improvements. This is the most restrictive action alternative and would likely result in the least environmental damage. A more complete description of Alternative 3 can be found in the Detailed Description of Alternatives.

1.3.4 Alternative 4 – Standard Lease Terms and Conditions and Special Stipulations That Address Other Significant Issues

Under this alternative, the Muddy Creek tract would be leased and mined with BLM standard lease terms and conditions, as well as special stipulations to balance and address significant social, economic, or environmental issues or opportunities identified during analysis of Alternatives 1-3. No major potential impacts were identified for Alternative 3; therefore, Alternative 4 is not analyzed in this technical report.

2.0 METHODS

2.1 CONTACTS MADE

The following resource specialists were contacted over the contract period to obtain data, species lists, and/or discuss survey methods and results:

Manti La-Sal National Forest, USDA Forest Service
- Rod Player, Wildlife Biologist, Price Ranger District, Price, UT
- Kara Staab, Former Wildlife Biologist, Ferron Ranger District, UT
- Jeff Jewkes, Wildlife Biologist, Ferron Ranger District, MLNF
- Rob Davies, Former Fisheries Biologist, Price Ranger District, Price, UT
- Pamela Jewkes, Fisheries Biologist, Ferron Ranger District, MLNF
- Dale Harber, Contracting Officer Representative, MLNF, Price, UT

Utah Division of Wildlife Resources (UDWR)
- Ron Hodson, Former Wildlife Biologist, Southeastern Region, Price, UT
  Current Wildlife Manager, Northern Region, Ogden, UT
- Chris Colt, Wildlife Biologist, Habitat Program Manager, Price, UT
- Craig Walker, Aquatic Biologist, Southeastern Region, Price, UT
- Louis Berg, Former Regional Aquatic Program Manager, Southeastern Region, Price, UT
- Amy Seglund, Sensitive Species Biologist, Southeastern Region, Price, UT

USDI Fish and Wildlife Service
- Laura Romin, T&E Species Biologist, Salt Lake Field Office, Salt Lake City, UT

Division of Oil, Gas, Mining
- Mark Mesch, Department of Utah Abandoned Mine Reclamation, Salt Lake City, UT

Utah State University (USU)
- Mark Vinson, Director, BLM BugLab & Research Assistant Professor, Department of Aquatic, Watershed, and Earth Resources, Logan, UT
- Jeff Ostermiller, Graduate Research Assistant, Aquatic Ecology Lab, Logan, UT

2.2 SOURCES AND DESCRIPTIONS OF EXISTING INFORMATION

- UTM coordinates for bald eagle nest near Castledale. Received from the UDWR, Southeastern District.

- Fisheries survey data and sample locations in the analysis area. Received from the UDWR, Southeastern District.

- Report for UDWR Project Number F-44-R containing data on fisheries surveys in the Muddy Drainage. (Hart and Berg 2003).

- Location of goshawk nesting territories in the vicinity of the analysis area. Received from the Forest Service, Ferron Ranger District.

- Bat survey report for the SUFCO Mine, Emery County, Utah. (Perkins and Peterson, 1997).

- General inventory report for spotted bats on the Wasatch Plateau, MLNF. (Toone 1993).

- Raptor survey data conducted by UDWR over the Pines and Muddy coal tracts. Digital coverage data clipped to the analysis area received from the UDWR Southeastern District.

- Digital coverage data for mule deer winter and summer range was acquired from the UDWR GIS Data website (http://dwrcdc.nr.utah.gov/ucdc/DownloadGIS/) and received clipped to the analysis area from the Southeastern District.

- Utah big game annual report - 2001. Publication Number 01-30. UDWR.

- Digital coverage data for elk winter and summer range was acquired from the UDWR GIS Data website (http://dwrcdc.nr.utah.gov/ucdc/DownloadGIS/) and received clipped to the analysis area from the Southeastern District.

- Elk population data received from the UDWR Northern Region.

- Predicted elk calving data model received from the Forest Service, Ferron Ranger District.

- Digital coverage data for blue grouse potential habitat was acquired from the UDWR GIS Data website (http://dwrcdc.nr.utah.gov/ucdc/DownloadGIS/).

- List of species of high federal interest received from the FWS, Salt Lake Field Office.

- Sage-grouse data collected by UDWR was acquired from the UDWR Southwestern Region. Digital coverage data of sage-grouse habitat was acquired from the UDWR GIS Data website.

- Potential presence of species of high federal interest, small-mammals, and non-game birds was predicted by consulting the following resources, in addition to the UDWR raptor data listed above:
  - Fauna of Southeastern Utah and life requisites regarding their ecosystems (Dalton et al. 1990). Publication No. 90-11.
  - The Birder's Handbook (Erlich et al. 1988).
  - Inventory of Sensitive Species and Ecosystems in Utah. Inventory of Sensitive Vertebrate and Invertebrate Species: A Progress Report (UDWR 1997).
  - Colorado GAP Analysis website (http://ndis.nrel.colostate.edu/cogap/). (CDOW 2001).
  - Utah Conservation Data Center. Utah Division of Wildlife Resources, UCDC website, species information and Utah distribution maps (http://www.utahcdc.usu.edu/ucdc).

- Land and Resource Management Plan for the MLNF. 1986 and 2003 amendments.

- Vegetative coverage for the Manti-La Sal National Forest: Division and Sanpitch Divisions downloaded from the Forest Geographic Data wesite (http://www.fs.fed.us/r4/mantilasal/downloads/).

- Final Environmental Impact Statement for the Pines Tract Project (Forest Service 1999).

2.3 DATA COLLECTION AND ANALYSIS METHODOLOGY

Wildlife surveys and/or habitat assessments were conducted as part of the contract stipulations for the coal tract evaluation project. Data was collected for the following categories of terrestrial and aquatic wildlife: federally listed threatened and endangered species, and Forest Service sensitive species (TEPS), management indicator species (MIS), species of high federal interest, sage-grouse, amphibians and reptiles, small mammals, and non-game birds. Surveys were conducted between 2001 and 2003 in the Muddy Creek coal tract and within a 2-mile buffer surrounding the tract. This entire area is referred to as the analysis area throughout this document. Table 1 summarizes the methods associated with data collection and analysis by species. More detailed discussion of wildlife inventory methods and results is included in section 2.4 below.

Table 1. Wildlife survey methodology for the Muddy analysis area, Manti-La Sal National Forest.

Species	Data Collection	Data Analysis
	TEPS	
Bald eagle (*Haliaeetus leucocephalus*) (Threatened)	Existing data acquired from UDWR. Incidental observations recorded by Cirrus. No formal survey was required.	Species presence or absence in the analysis area determined with the use of GIS. No digital coverage was created because no nests were found.
Cutthroat trout (*Oncorhynchus clarki*) (FS Sensitive)	Existing survey data acquired from the UDWR. No formal survey by Cirrus was required.	Species presence or absence in the analysis area determined with the use of GIS. Digital coverage of surveyed reaches created from written descriptions and/or UTMs with ESRI ArcView software.
Northern goshawk (*Accipiter gentilis*) (FS Sensitive)	Presence/absence surveys conducted by Cirrus over two field seasons. Region 4 survey protocol for northern goshawks used (USDA-FS 1993).	Digital coverage of species presence (based on vocal responses and goshawk observations) and survey points created with Microsoft Excel and ESRI ArcView software.
Flammulated owl (*Otus flammeolus*) (FS Sensitive)	Presence/absence surveys conducted by Cirrus over two field seasons. UDWR Northern Region forest owl inventory protocol used (UDWR 1992).	Digital coverage of species presence (based on vocal responses) and survey points created with Microsoft Excel and ESRI ArcView software.
Three-toed woodpecker (*Picoides ridactytus*) (FS Sensitive)	Presence/absence surveys conducted by Cirrus over one field season. UDWR and UNHP (1992) woodpecker survey protocol used.	Digital coverage of species presence (based on vocal responses and woodpecker observations) and survey points created with Microsoft Excel and ESRI ArcView software.
Spotted bat (*Euderma maculatum*) (FS Sensitive)	Structural habitat searches were conducted and incidental sightings were recorded by Cirrus over two field seasons. Survey data from the Utah Natural Heritage Program and the SUFCO mine was acquired.	Digital coverage of species presence (based on audible vocalizations) created with Microsoft Excel and ESRI ArcView software.
Western big-eared bat	Conducted habitat assessment surveys using information on mine status. Structural	Survey results discussed in a narrative.

Table 1. Wildlife survey methodology for the Muddy analysis area, Manti-La Sal National Forest.		
Species	**Data Collection**	**Data Analysis**
(*Corynorhinus townsendii pallescens*) (FS Sensitive)	habitat searches also conducted. Survey data from the Utah Natural Heritage Program and the SUFCO mine was acquired.	
MIS		
Golden eagle *(Aquila chrysaetos)*	Aerial survey for golden eagle nest sites conducted by Cirrus and UDWR in 2002. Additional survey data for the analysis area acquired from UDWR.	Digital coverage of nest locations created by UDWR and clipped to the project area by Cirrus with Microsoft Access, and ESRI ArcView software.
Mule deer (*Odocoileus hemionus)* and elk *(Cervus elaphus)*	Existing survey and habitat modeling data acquired from UDWR. No formal survey by Cirrus was required.	Digital coverage of winter and summer range created by UDWR and clipped to the project area by Cirrus with Microsoft Access and ESRI ArcView software.
Blue grouse[1] (*Dendragapus obscurus*)	Incidental sightings recorded by Cirrus. No formal survey was required. Habitat modeling data acquired from UDWR.	Digital coverage of incidental sightings created by Cirrus with Microsoft Excel and ESRI ArcView software.
Aquatic macro-invertebrates	Baseline data surveys were conducted for three years during the spring and fall by Cirrus. Macroinvertebrate samples and stream habitat data were collected. The USU/BLM National Aquatic Monitoring Center stream invertebrate sampling protocol was used (Hawkins et. al 1998).	Macroinvertebrate samples were analyzed by the National Aquatic Monitoring Center, Department of Aquatic, Watershed, and Earth Resources, Utah State University. Species abundance, diversity, and biotic health indices were generated. Digital coverage of survey areas created with Microsoft Excel and ESRI ArcView.
Species of High Federal Interest		
Migratory birds[2]	Presence/absence surveys were conducted in suitable habitat by Cirrus over one field season. Incidental observations also made. Raptor nest data acquired from UDWR.	Digital coverage of observed territories created with Microsoft Excel and ESRI ArcView software.
Other Wildlife Species		
Sage-grouse (*Centrocercus urophasianus*)	Presence/absence surveys were conducted in suitable habitat by Cirrus over one field season. Incidental observations also made. Lek counts were made by Cirrus and UDWR.	Digital coverage of species presence and sign, survey areas, and lek sites created with Microsoft Excel and ESRI ArcView.
Amphibians	Presence/absence surveys were conducted in suitable habitat by Cirrus over two field seasons.	Digital coverage of suitable habitat and species presence created with Microsoft Excel and ESRI ArcView.
Reptiles	Incidental sightings recorded by Cirrus. No formal surveys required since construction of mining facilities and roads was not proposed.	Species observations summarized in text.
Small mammals	Incidental sightings recorded by Cirrus. No formal surveys required. UDWR reports acquired.	Probability of occurrence analysis conducted using existing literature and other resources. Results summarized in tabular format.
Non-game birds	Incidental sightings recorded by Cirrus. No formal surveys required. UDWR reports acquired.	Probability of occurrence analysis conducted using existing literature and other resources. Results summarized in tabular format.

[1]Note that the blue grouse is no longer a MIS. It was replaced in June 2003 by the Northern goshawk in an amendment to the MLNF Forest Plan.
[2]Migratory bird species of High Federal Interest are shown in Table 4.
[3]Note that the greater sage-grouse was added to the Region 4 sensitive species list in December 2003.

2.4 DESCRIPTION OF INVENTORIES AND DATA COLLECTED BY THE CONSULTANT

A description of field surveys and other forms of data acquisition, including survey methods and results, is discussed below in sections 2.4.1 - 2.4.4. Order of species described follows that outlined above in Table 1. Summary figures and tables, where applicable, are included in Appendices A, B, D, and E. In addition to the required survey data, general species lists were generated to document incidental wildlife sightings in the analysis area and are included in Appendix C.

2.4.1 TEPS Wildlife Surveys

2.4.1.1 Bald eagle

Data on bald eagle nest sites was acquired from the UDWR and is reported below.

There are no known bald eagle nests present on the Muddy tract or elsewhere on the Manti-La Sal National Forest. The closest nest is on private land about 18 miles east of the northeastern boundary of the analysis area, near the town of Castledale. It is unlikely that individuals from this eagle pair would utilize portions of the analysis area for foraging, since suitable habitat is available closer to the nest site. Five bald eagle individuals (3 adults and 2 juveniles) were observed in November 2003 along Cowboy Creek, presumably during fall migration. No other observations of this species were made during field visits between March and November, 2001-2003.

2.4.1.2 Colorado River cutthroat trout

Fish survey data was requested from the UDWR for perennial streams located within the Muddy analysis area. Surveys were conducted by UDWR personnel using standard electrofishing procedures. Streams surveyed included Muddy Creek, South and North Forks of Muddy Creek, and the North Fork of Quitchupah Creek. Fish surveys in other streams within the analysis area were not conducted. Cutthroat trout, believed to be of the Colorado River subspecies, were recorded during the most recent survey efforts in Muddy Creek and South Fork of Muddy Creek. Cutthroat trout were also observed incidentally in the North Fork of Muddy Creek, but electrofishing surveys have not been conducted there to date. Cutthroat trout were not observed within the North Fork of Quitchupah Creek. Results of the fisheries surveys are recorded by stream reach in Table 2. Cutthroat trout collected were assumed native. Rainbow trout and brook trout are introduced (non-native). Locations of sampled stream reaches were mapped and are depicted in Figure A-1, Appendix A. A digital coverage of the surveyed reaches in Figure A-1 is provided in conjunction with this report.

Region 1/4 aquatic habitat inventory data was not collected for fish-bearing streams by UDWR and was not part of the Cirrus proposed work plan for RFP 10-00-064. However, baseline habitat data was collected by UDWR at the sampled reaches and is reported below in Table 3. Habitat quality is summarized in Table 2.

Anthropogenic activities have led to the deterioration of riparian habitats and streams. Landslides, bank erosion, and sedimentation continue to impact streams and consequently fish habitat. The deterioration of riparian areas has reduced their capacity to provide shade to streams and to trap and retain sediments and pollutants from upslope areas. All these factors are contributing to the deterioration of fisheries resources.

Fish species not observed during surveys but predicted to occur or formerly observed in Muddy Creek include flannelmouth sucker, bluehead sucker and speckled dace. Fish species potentially present in Quitchupah Creek include flannelmouth sucker, leatherside chub, mountain sucker, and speckled dace.

Table 2. Fisheries surveys within the Muddy analysis area in the Manti-La Sal National Forest.

Waterbody	Survey Date	Species Observed	Average Fish Size (Range)	Habitat Quality
Muddy Creek	July 2002	Cutthroat trout (most abundant) Rainbow trout Brook trout	Cutthroat: 198 mm (91-296 mm) Rainbow: 297 mm (only 1 collected) Brook: 135 mm (only 1 collected)	Moderate to high quality trout habitat.
South Fork Muddy	July 2002	Cutthroat trout (most abundant) Rainbow trout	Cutthroat: 188 mm (100-278 mm) Rainbow: 281 mm (only 1 collected)	Moderate to high quality trout habitat.
North Fork Muddy[1]	Never formally surveyed	Cutthroat trout observed in July 2002 about 2 miles above the confluence with Muddy Creek. Unidentified trout species observed in stream in summer 2002 and 2003.		Moderate to high quality trout habitat.
North Fork of Quitchupah Creek (one location)	October 2001	No fish observed at either location.	No fish collected	Unsuitable above Forest Road 007 because of erosion, siltation, and low water flows. Potentially suitable below road due to suitable flow and riparian area.

[1] Survey planned for this waterbody in summer 2004.
Data source: State of Utah Natural Resources, Division of Wildlife Resources, Southeastern Region. Louis Berg, Regional Aquatic Program Manager. Berg 2002a, 2002b, and 2002c, and Hart and Berg 2003.

Table 3. Stream habitat data for fisheries surveys conducted within the Muddy analysis area, Manti-La Sal National Forest, 2001 – 2002.

Waterbody	Avg. Stream Width (ft)	Avg. Stream Depth (ft)	Substrate Rating	Cover Rating
Muddy Creek	24.6	0.57	Excellent >75% gravel/cobble/ boulder, <25% sand/silt	Poor <25% of stream shaded
South Fork Muddy	14.9	0.50	Excellent >75% gravel/cobble/ boulder, <25% sand/silt	Poor <25% of stream shaded
North Fork of Quitchupah Creek (at FS Road 007 crossing)	3.5	0.30	Good >50% gravel/cobble/ boulder,<50% sand/silt	Fair-good >25% of stream shaded, possibly >50% of stream shaded

2.4.1.3 Northern goshawk

Surveys for northern goshawks were conducted in suitable foraging and nesting habitat in the analysis area from June 21 to July 19 in 2001, July 9 to August 1 in 2002, and July 14 to July 17 in 2003. The survey periods were selected to coincide with portions of the nestling period in 2001and the post-fledgling dependency period in 2002-2003. Suitable goshawk habitat was defined as gentle to moderate slopes (0-30%) containing mature conifer stands with closed canopies and open understories. Aspen stringers near perennial streams were also considered suitable nesting habitat, regardless of the grade of the adjacent slopes.

2.4.1.3.1 Survey Methods

Survey methods outlined in the draft Region 4 survey protocol for northern goshawks (USDA-FS 1993) were used to determine the presence of goshawks in the analysis area. The method employed the use of a conspecific broadcast calling tape of an adult northern goshawk alarm call and a portable tape player with external speakers capable of broadcasting at 90-100 decibels at one meter from the source. The taped alarm calls were played back as repeated sequences of 10 seconds of alarm calls followed by a 30-second observation period. At each broadcast station, the observer played a total of three sets of the 10 seconds of alarm call/30 seconds of observation sequence, rotating 120 degrees after each set. During all observation periods, the surveyor scanned the area vertically and horizontally for goshawks. Calling surveys were conducted during daylight hours, primarily from sunrise until early afternoon (about 14:00). No surveys were conducted in inclement weather (i.e., rain or wind).

Survey routes were determined using transects drawn on USGS topographic maps over areas containing suitable goshawk nesting and foraging habitat. Suitable habitat was determined by examining Forest Service vegetation coverage maps and aerial photos, and by field reconnaissance. Survey calling stations were located at approximately 900 feet intervals along transects to promote effective coverage of suitable habitat.

A digital coverage of the goshawk calling points and positive responses was created in Microsoft Excel. This coverage is being provided in conjunction with this report. The coverage was mapped in ArcView and overlaid onto the existing Forest Service vegetation layer to better assess distribution of positive responses in relation to habitat type (see Figure A-2, Appendix A). Results of the surveys are discussed below.

2.4.1.3.2 Survey Results

In 2001, 110 calling points were surveyed for northern goshawks. In 2002, these calling points were resurveyed and 102 new points were surveyed because of the additional potential habitat identified from vegetation maps or during field visits. In addition, goshawk alarm calls were broadcast at 59 of the stations surveyed for three-toed woodpecker between June 8 and June 23, 2002, to see if a response could be prompted earlier in the breeding season. Of these stations, 52 were resurveyed later in the year as part of the regular goshawk survey effort. In 2003, stations visited for the first time in 2002 were revisited, except where habitat was deemed unsuitable, so that each station with suitable habitat was visited twice over the 3-year study period.

Positive responses were received at three calling stations in the Muddy analysis area in 2001, two calling stations in 2002, and one calling station in 2003. One of the responses in 2002 was at a station where a response was also received in 2001. Goshawk responses were associated with mixed conifer/aspen forest at elevations above 8,650 feet. Positive responses were either silent fly-overs or vocalizations of adult birds. Of the responses in 2001, two were silent fly-overs and the third bird was flushed from a tree. Two of these responses were most likely from the same individual as the goshawk flew from the direction of

the last positive calling station within fifteen minutes of the original response. Of the two responses in 2002, one goshawk flew in and vocalized and perched on a tree, the other one vocalized but did not fly in. In 2003, the response consited of a single alarm call. Four of the responses were in the forested patches west of the tract, inside the buffer, and two were inside the tract. The number of responses observed does not represent the number of individuals. The responses were likely from individuals of one (or possibly two) goshawk pair or family unit. No physical nests were observed but it was assumed that there was at least one active nest in the area. In addition to the surveys, one incidental visual observation was made in September 2003, when an adult goshawk was seen flying over Black Fork Creek then disappearing into the forest canopy on the other side of the creek, near its confluence with the South Fork Muddy Creek.

In summary, two years of surveys were completed for all suitable goshawk habitat within the analysis area during the 3-year survey effort. Positive responses were received at five calling stations, including 2 responses at one of the stations, for a total of 6 responses. No nests or juveniles were found but it is assumed that there was at least one active nest in the survey area.

2.4.1.4 Flammulated owl

Surveys for flammulated owls were conducted in suitable foraging and nesting habitat in the analysis area from June 20 to July 19 in 2001, June 7 to June 26 in 2002, and on June 25, 2003. Survey periods were selected to correspond with the breeding season when male owls were most likely to vocalize to signal their occupied territory. Suitable owl habitat was originally defined as pine woodlands, especially ponderosa pine. After owls were heard in alternative habitat types in the survey area, this definition was expanded to include mixed conifer forest stands that included an aspen and pine component.

2.4.1.4.1 Survey Methods

A forest owl inventory protocol (UDWR 1992), developed for use in the Northern Region and received from the Utah Department of Natural Resources, was followed to determine the presence of flammulated owls in the analysis area. The survey method employed the use of a conspecific broadcast calling tape of male flammulated owl vocalizations. The same equipment used for the goshawk surveys was used for owl surveys. Surveys consisted of broadcasting repeated sequences of a 30-second adult owl call followed by a 15-second period of silence. Twenty minutes were spent at each survey station. After listening for owls for 3 minutes, calls were broadcast in four directions, rotating 90 degrees every 4 minutes, approximately. Broadcast calling surveys began one-half hour after dusk, and continued throughout the night, as late as 3:30 am. Surveys were aborted or not conducted if it was rainy or windy.

Survey routes were determined using transects and isolated points, drawn on USGS topographic maps over areas containing suitable flammulated owl nesting and foraging habitat. Suitable habitat was determined by examining Forest Service vegetation coverage maps and aerial photos, and by field reconnaissance. Survey calling stations were located at approximately 0.5-mile intervals along transects, and 0.5 miles apart when isolated, to promote effective coverage of suitable habitat.

A digital coverage of the flammulated owl calling points and positive responses was created in Microsoft Excel. This coverage is being provided in conjunction with this report. The coverage was mapped in ArcView and overlaid onto the existing Forest Service vegetation layer to better assess distribution of positive responses in relation to habitat type (see Figure A-3, Appendix A). Results of the surveys are discussed below.

2.4.1.4.2 Survey Results

In 2001, surveys were conducted at 38 calling points. In 2002, calling points that had no response in 2001 were resurveyed, and 15 new points were surveyed to cover additional potential habitat. These new points were resurveyed in 2003 unless a positive response was recorded in 2002.

Owls responded to broadcast calls at a total of 26 stations in the analysis area over the 3-year survey period. Twelve flammulated owl responses were elicited from surveys conducted in 2001, twenty owl responses in 2002, and one in 2003. A flammulated owl was also heard incidentally along Cowboy Canyon in May 2003, at a location where no response had been recorded during the 2001 and 2002 surveys. At some of the stations, more than one owl responded to calls during the survey visit. The habitat surrounding the stations where positive responses were recorded can be categorized into ponderosa pine, limber pine and aspen, and mixed conifer and aspen forest types. The number of responses does not indicate the number of owl pairs on the tract, as unpaired male flammulated owls are thought to call more during the breeding season than paired owls. However, we can assume that numerous pairs are utilizing the survey area based on the high number of male responses and the presence of suitable habitat throughout the tract. In addition to flammulated owls, great-horned owls occasionally responded to the broadcast calls. Calling effort was aborted at these stations once the great-horned owl was heard. A saw-whet owl was also heard calling on the tract during a flammulated owl survey in 2001.

In summary, two years of surveys were completed for all suitable flammulated owl habitat within the study area during the 3-year survey effort. Positive responses were received at 26 calling stations in the survey area, for a total of 33 responses, as more than one owl responded at some of the stations. Some of these responses were likely from the same individuals as they were received at adjacent calling stations. It is assumed that several pairs of flammulated owls occur in the analysis area.

2.4.1.5 Three-toed woodpecker

Surveys for three-toed woodpeckers were conducted in suitable foraging and nesting habitat in the Muddy analysis area from June 21 to July 19 in 2001 and May 24 to June 23 in 2002. Survey periods were selected to coincide with the nest excavation period. Suitable woodpecker habitat was defined as spruce-fir forests, especially those that had been recently infested by bark beetles.

2.4.1.5.1 Survey Methods

A modification of the northern three-toed woodpecker inventory protocol, received by the Forest Service in 2001 (UDWR and UNHP 1992) was used to conduct surveys. The method employed the use of a con-specific broadcast calling tape of an adult three-toed woodpecker call plus three intermittent episodes of drumming and silence. The tape was played using a portable tape player with external speakers capable of broadcasting at 90-100 decibels at one meter from the source. The tape was played back as a repeated sequence of 10 seconds of calls and drumming followed by a 30-second observation period. At each survey station, the observer broadcast the call in all four cardinal directions for a total of eight minutes (2 minutes in each direction). During the observation periods, the surveyor scanned the area vertically and horizontally for woodpeckers and listened for drumming responses. Calling surveys were conducted during daylight hours, primarily from sunrise until early afternoon, when it became too warm (about 14:00). No surveys were conducted in inclement weather (i.e., rain or wind).

Survey routes were determined using transects drawn on USGS topographic maps over areas containing suitable three-toed woodpecker nesting and foraging habitat. Suitable habitat was determined by examining Forest Service vegetation coverage maps and aerial photos, and by field reconnaissance. The majority of transects traversed for goshawk surveys were used also for woodpecker surveys, because of the similarity of habitat requirements. When the same transects were used for both species, the survey calling stations were located at approximately 900 feet intervals. When transects were used to survey only for woodpeckers, the calling stations were located at intervals ranging between 0.15 and 0.25 miles, depending on terrain and forest density. If surveys were conducted for woodpeckers and goshawks during the same time interval, the woodpecker calls were always broadcast first.

A digital coverage of the three-toed woodpecker calling points and positive responses was created in Microsoft Excel. This coverage is being provided in conjunction with this report. The coverage was mapped in ArcView and overlaid onto the existing Forest Service vegetation layer to better assess distribution of positive responses in relation to habitat type (see Figure A-4, Appendix A). Results of the surveys are discussed below.

2.4.1.5.2 Survey Results

In 2001, 98 calling stations were surveyed, which comprised the best habitat in the tract. In 2002, 96 new calling stations were surveyed, which contained a variety of habitat including poor (canyon edges), marginal, and suitable habitats. In addition, 32 calling stations visited in 2001 were resurveyed in 2002 because they were originally surveyed after July 15, towards the end of the nest excavation period.

Fifteen woodpecker responses resulted at twelve calling stations in 2001. Six of these responses were paired, and one was incidental, occurring in the same location as a prior positive response. One woodpecker responded during the survey effort in 2002, and an additional one was observed incidentally during a goshawk survey in mid-July, when an adult female was observed drumming and flying. No nest sites were found. Positive identifications were made visually and aurally and were associated with dense forested habitats above 8,800 feet that contained patches of snags. Woodpecker responses consisted of drumming or a combination of flying to a few different trees and snags and drumming. All of the responses were in the spruce beetle infested forest habitat within the survey buffer, west of the tract boundary. Although, for a given year, it is difficult to determine the exact number of individuals observed during surveys, it can be assumed that there were at least three, and potentially more, woodpecker pairs nesting on the tract. This assumption is made based on the number of pairs observed, timing of and distance between positive survey responses, and home range size.

In summary, all suitable three-toed woodpecker habitat was surveyed at least once between 2001 and 2002. Responses were received at 13 calling stations in the Muddy analysis area, for a total of 16 responses, as both birds in a pair responded at three stations. Additionally, a female was observed incidentally in the area during a goshawk survey. It is assumed that three or more nesting pairs were present during the survey period.

2.4.1.6 Spotted bats

Surveys for spotted bats were conducted by Cirrus in potential roosting habitat in the Muddy analysis area in 2001 and 2002. Spotted bats have been recorded in a variety of habitats, including open ponderosa pine, desert shrub, pinyon-juniper, and open pastures and hay fields. Foraging occurs in riparian areas and open meadows with wet seeps or wetlands. Roosting habitat is more restrictive, being confined to rock crevices or overhangs associated with large cliff faces. Roosting habitat for spotted bats is abundant in vertical cracks of the sandstone cliff faces of the steep canyons in the tract. The riparian habitat and forest edges in the tract also provide potential foraging opportunities.

2.4.1.6.1 Survey Methods

Surveys for spotted bats in 2001 and 2002 consisted of structural searches of rock crevices or overhangs of cliffs that potentially support roosts sites. Due to the hazards of steep cliff terrain, searches were confined to areas accessible safely by foot. No rock-climbing or repelling gear was used. The following structures were searched for bat roosts in the analysis area: Muddy Canyon east of Box Canyon, Greens Canyon, the East Fork of Box Canyon, the head of Box Canyon, and the North Fork of Quitchupah Canyon.

In addition to roost site searches, incidental observations of spotted bats were recorded. Spotted bat vocalizations are audible. The only other audible bat species in Utah, Allen's big-eared bat and the big-

free-tailed bat, do not occur within the range of the project area (Oliver 2001). Therefore, when audible bat detections were made, it was assumed that the species heard was the spotted bat. UTM coordinates were recorded for these observations and were used to create the digital coverage provided in conjunction with this report.

2.4.1.6.2 Survey Results

No roosting sites or sign of bats were found during structural searches in the analysis area.

Numerous spotted bats were identified in the survey area by audible vocalizations or a combination of vocalizations and visual detection. Observations were made primarily in conjunction with nighttime flammulated owl survey efforts. A total of 36 spotted bat observations were recorded. Observations were associated with the rocky cliff habitat and ponderosa pine along the east fork and main stem of Box Canyon and along Greens and Cowboy Canyons. Bats were also observed foraging in the limber pine habitat near Julius Flat Reservoir and above the North Fork of Muddy Creek, and in the limber pine/Douglas fir habitat along the jeep trail running west and south of Cowboy Creek. Bat observations were mapped in ArcView and overlaid onto the existing Forest Service vegetation layer to better assess their distribution in relation to habitat type for the analysis area (see Figure A-5, Appendix A).

See section 2.4.1.8 for results of additional bat surveys conducted by other parties.

2.4.1.7 Western big-eared bats

Surveys for western big-eared bat (also known as Townsend's big-eared bat; *Corynorhinus townsendii*), were conducted by Cirrus in potential hibernacula and roosting habitat in the Muddy analysis area in 2001 and 2002. Western big-eared bats have been recorded in juniper/pine forests, shrub/steppe grasslands, deciduous forests, and mixed coniferous forests. They roost in hibernacula within caves, abandoned mine shafts, and occasionally in old buildings. Winter hibernacula for big-eared bats is very scarce in the analysis area due to the scarcity of suitable caves and open mine shafts. Cliff overhangs and shelter caves eroded in the sandstone cliffs could provide potential summer roosting habitat.

2.4.1.7.1 Survey Methods

Before surveys were initiated, the status of mines in the area was determined. One inactive mine, The Richie Mine, is present in the survey area. This mine was visited and determined closed because of lack of visible openings. The Link Canyon mine, just south of the buffer boundary is closed, with the exception of a small magazine, roughly 4 by 4 by 8 feet. One active mine, the Sufco mine, is present within and west of the Muddy analysis area, with its operating facilities southwest of the tract buffer boundary.

Surveys for western big-eared bats in 2001 and 2002 consisted of structural searches of rock overhangs and magazines that potentially support roost sites or hibernacula. These surveys were conducted concurrently with those for spotted bats and included searches of accessible structures in Muddy Canyon east of Box Canyon, Greens Canyon, the East Fork and head of Box Canyon, and the North Fork of Quitchupah Canyon. The Richie Mine and tramway were visited to determine the status of the mine and look for potential hibernacula. A rock overhang exists at the head of Box Canyon and was surveyed for sign of bat roosts. In addition, the magazine at Link Canyon Mine was surveyed for roosting bats. Because big-eared bats are highly susceptible to temperature changes and disturbance, they would not occupy an active mine, thus the Sufco mine was not considered for the survey effort.

2.4.1.7.2 Survey Results

No roosting sites, potential hibernacula, or bat sign were found during structural searches in the tract. No substantial caves were observed on the tract and no other structures were considered potentially suitable

for western big-eared bat hiberbacula. No mine openings were found at the Richie Mine site after an extensive search of the area, and no bat sign was observed. This mine was considered closed. No bats or bat sign were observed in the magazine in Link Canyon Mine. Because of the disturbance of this opening by cattle and vehicular traffic, it is unlikely that western big-eared bats would roost there. Since no big-eared bats and little suitable habitat were observed, a digital coverage for this species was not created.

See section 2.4.1.8 for results of additional bat surveys conducted by other parties.

2.4.1.8 Additional Bat Surveys

2.4.1.8.1 Cooperative Challenge Cost Share Project

A general inventory was conducted for spotted bats in selected areas on the Ferron Ranger District in 1992 as part of a coperative challenge cost share project between the MLNF and Utah Natural Heritage Program (Toone 1993). The survey methods employed consisted of listening for spotted bat audible echolocation sounds and categorizing them as a "bat pass" or a "foraging buzz", represented by the rate of echolocation heard, and mist netting. Survey locations were by Quichupah Creek, just south of the Muddy tract boundary.

No bats were captured in mist nets at Quichupah Creek, but audible bat detections were made on two occasions during the netting period. Bat activity was noted as low at this site.

2.4.1.8.2 SUFCO Mine Bat Survey

Surveys for spotted and western-big-eared bats were conducted in 1997 in Link, Muddy Creek, and Box Canyons as part of the SUFCO and Dugout Canyon Mine's permit requirements (Perkins and Peterson 1997). Four different survey methods were employed, including structure searches, mist netting, bat detectors, and audible bat transects. The survey area overlapped with the eastern portion of the Muddy tract and buffer, therefore, the SUFCO survey results are likely indicative of the species composition in the analysis area.

Results of the structure searches yielded no bats or bat sign in any shelter caves or in the Link Canyon magazine. No habitat suitable for western big-eared bats was observed. Mist netting resulted in the capture of California myotis (*Myotis californicus*) and Yuma myotis (*M. yumanensus*) in Link Canyon, and no species at Muddy Creek. The bat detector surveys resulted in the detection of spotted bats, as well as numerous other bat species including California myotis, Yuma myotis, big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagrans*), small-footed myotis (*M. ciliolabrum*), long-eared myotis (*M. evotis*), little brown bat (*M. lucifuus*), western pipistrelle (*Pipistrellus hesperus*), and an unidentified *Myotis* species. No western big-eared bats were detected. Transect surveys resulted in detection of spotted bat calls in nearly all stations in lower Box Canyon and throughout Muddy Canyon. No calls were heard in the upper reaches of the three canyons or in Link Canyon.

The results of the surveys conducted by Perkins and Peterson (1997) suggest that these canyons do not contain suitable habitat for western big-eared bats; suitable structures for day roosting and hibernacula are absent. Cliff habitat below the rims of Muddy Creek Canyon and the lower reaches of Box Canyon surveyed by Perkins and Peterson (1997) appear to provide ample habitat for spotted bats.

2.4.2 Management Indicator Species

2.4.2.1 Golden eagle (UPDATE)

Surveys for golden eagles were conducted in May 2002 in suitable nesting habitat in the Muddy analysis area with the assistance of UDWR. Additional golden eagle survey data was acquired for this area from UDWR for the period between 1998 and 2003. Suitable habitat was defined primarily as tall cliffs and occasionally trees.

2.4.2.1.1 Survey Methods

Aerial helicopter surveys were conducted annually during the eagle breeding season by UDWR. Survey methods included flight transects over and adjacent to suitable cliff habitat and some forested habitat. When nests were observed, the UTMs of the location were recorded, and the type (species) and status (active, inactive, tended) of the nest were determined, if possible. Cirrus participated with the survey effort in 2002.

A digital coverage of the flight lines and nest locations was created in Microsoft Access. A map was created for the analysis area which depicts the location and status of golden eagle nests for each year surveyed (see Figure A-6, Appendix A). Results of the surveys are discussed below.

2.4.2.1.2 Survey Results

In 2002, 12 golden eagle nests were known in the analysis area, of which 11 were surveyed. Of these, none were active, two were tended, seven were inactive, one was dilapidated, one was not found, and one was not surveyed. No eagles were seen during this survey effort. In 2003, eight of the known nests were surveyed. Of these, none were reported as active, but two were tended. No new golden eagle nests were identified during this survey effort and no golden eagles were observed. Results from surveys between 1998 and 2003 are depicted below in Table 4. Of all the golden eagle nests in the analysis area, one has been active at least once over the last six years and seven additional nests have been tended at least once.

Incidental sightings of golden eagle individuals were made during summer 2002. One observation was made of an eagle soaring over the North Fork Muddy Creek near the junction with the South Fork. The other observation was of a golden eagle perching and vocalizing on a tree and then soaring over the main stem of the Muddy Creek about one mile below the confluence of the South and North Forks. One individual was seen flying over the North Fork of Muddy Creek in July 2003 and several eagle observations were made over the main stem of Muddy Creek in 2002 and 2003.

Table 4. Golden Eagle Surveys Conducted in the Muddy analysis area by UDWR, 1998-2003.

Species	Nest Status	2003	2002	2001	2000	1999	1998
Golden eagle	Active	0	0	0	0	0	1
	Tended	2	2	2	2	1	1
	Inactive	6	7	7	5	4	4
	Dilapidated	0	1	0	0	1	1
	Not found	0	1	1	0	1	0
	Not surveyed	4	1	0	2	2	0
	Total	**12**	**12**	**10**	**9**	**9**	**7**

2.4.2.2 Mule Deer

Data on mule deer was acquired for the Muddy analysis area from UDWR.

The Muddy analysis area contains winter and summer range for mule deer. The value of this range is classified as high summer and high winter. The range combined covers over 90 percent of the analysis area. The extent of these ranges within the analysis area is depicted in Figure A-7 in Appendix A and is provided as a digital coverage in conjunction with this report.

No true migration routes have been identified by the UDWR or Forest Service in the analysis area. Since the area contains both winter and summer range, movements are not extensive, and follow the seasons. All areas are used, and the animals move from place to place as necessary.

Fawning areas also have not been identified, studied, reported, or mapped by these agencies. It is assumed that fawning potentially occurs in all suitable habitats. In the analysis area, suitable fawning habitat coincides with coniferous forests, mixed aspen coniferous forest, young aspen stands, and mountain brush and mahogany cover types, with the latter being preferred because of the protective cover it affords. These habitats occur in the western and southern portions of the analysis area. Deer fawning habitat overlaps elk calving habitat to some degree.

2.4.2.3 Elk

Data on elk was acquired for the Muddy analysis area from UDWR.

The Muddy analysis area contains winter and summer range for elk. The value of this range is classified as critical summer and critical winter. The range combined covers over 90 percent of the analysis area. The extent of these ranges within the analysis area is depicted in Figure A-8 in Appendix A and is provided as a digital coverage in conjunction with this report.

No true migration routes have been identified or mapped by the UDWR or Forest Service in the analysis area. Since the area contains both winter and summer range, movements are not extensive, occur between ranges, and follow the seasons. All areas are used, and the animals move from place to place as necessary. In some years they move greater distances than others, depending on the weather and available resources.

Calving areas also have not been identified, studied, reported, or mapped by these agencies. It is assumed that calving potentially occurs in all suitable habitats. In the analysis area, suitable calving habitat coincides with aspen forests and mountain brush and mahogany cover types. Predicted calving areas occur in the southwestern portion of the analysis areas, as far north as Julius Flat Reservoir, and as far south as the North Fork of Quitchupah Creek (Hodson 2004). Potential calving habitat was modeled by the MLNF. Modeled habitat coincided with the aforementioned predicted habitat, but also occurred in the northwest portion of the analysis area. In total, modeled habitat occurred in about 10 percent of the analysis area, of which roughly 2.5 and 7.5 percent occurred in the tract and 2-mile buffer, respectively. Modeled calving habitat was associated primarily with aspen and aspen mixed conifer habitat types that were close to water (Jewkes 2004b).

2.4.2.4 Blue Grouse

No formal surveys were required for this species. Incidental observations were made while traversing potential habitat during goshawk, woodpecker, and amphibian surveys. Suitable habitat was defined as open stands of conifers or aspen with brushy understory. Potentially suitable habitat for blue grouse is present, primarily in the western portion of the Muddy analysis area.

In 2001, one adult was observed just off of Road 044 in the Greens Hollow area. In 2002, one adult blue grouse and five chicks were observed not far from this location. The surrounding habitat was a mix of small aspen and mountain shrubs. A group of four grouse consisting of one adult and three subadults was observed in 2002 above Cowboy Creek. The birds were flushed from underneath some shrubs. The area where they were observed was an opening containing grass and scattered shrub patches. Aspen and conifer patches were adjacent to this opening. In September 2003, four adults were observed at the edge of a clearing (campsite) lined by young aspen and shrubs, near Julius Flat Reservoir, and two adults were observed near Brush Reservoir (UTMs not recorded).

A digital coverage of the locations of grouse observations was created with Microsoft Excel. This coverage is depicted in Figure A-9 in Appendix A and is provided in conjunction with this report. A digital coverage of year-round blue grouse habitat based on known use areas in the late 1980s was created by UDWR in 2000. The area mapped as grouse habitat does not overlay the analysis area. Therefore, this coverage is not provided.

2.4.2.5 Macroinvertebrates

Surveys for aquatic macroinvertebrates were conducted in late spring and late summer/early fall in 2001, 2002, and 2003. Sampling took place in small perennial streams in the Muddy analysis area. Stream levels were much higher in the spring than in the summer or fall, as the streams received additional water from snowmelt and runoff in the spring, and only minimal additional water from rainfall throughout the summer.

Sampling methods outlined in the field protocol developed by Utah State University and the BLM National Aquatic Monitoring Center (Hawkins et. al 1998) were used to determine the abundance and diversity of stream invertebrate assemblages. A 500-micron mesh surber net was used to collect samples, and invertebrates were immediately preserved in a solution of 75% ethanol and 10% formaldehyde. Where possible, two invertebrate samples were taken from each site: a constant area sample and a qualitative sample. The constant area sample was a compilation of eight $0.09m^2$ fixed-area samples taken from four different habitat units (e.g. riffles and runs). The qualitative sample consisted of a single 10-minute sample taken from all major habitat types in approximate proportion to their occurrence. When water levels were too low to get an adequate quantitative sample, only a qualitative sample was taken. Physical habitat data was also recorded, for use in the computation of biotic indices.

In the Muddy analysis area, four sites were sampled that would be potentially impacted by mining activities. All four sites were within the tract boundary. In addition, a control site located outside the zone of potential impact was sampled. Site selection was based on the same criteria used to select water quality monitoring stations (relatively straight perennial stream reaches in narrow channels that were above or below reaches with bedrock substrate). Therefore, the same sites used to monitor water quality were selected for invertebrate sampling. The criteria used for selecting the control site were as follows: the stream must be 1) outside the buffer zone, 2) a perennial stream, 3) minimally impacted by human and natural disturbances, and 4) most closely reflected the conditions at the four sample sites. The site that most closely met these criteria was an unnamed stream near White Mountain Cabin, which is located on the westernmost side of the tract buffer. This site marginally met criterion number 1, in that it is just inside the buffer zone (within 0.3 miles of the boundary). However, this site is a good representation of a perennial stream in the area, and is outside of the zone of subsidence that could result from proposed mining activities. Furthermore, the stream source is well outside the buffer boundary (approximately 0.43 miles from buffer boundary and 1 mile from the sampling location). It was very difficult finding a control site that had similar substrate, adjacent vegetation communities, hydrology, and shape to the four sample sites. The selected site was the closest match, and was approved by the Forest Service hydrologist, Katherine Foster.

A digital coverage of macroinvertebrate sampling stations was created in Microsoft Excel. This coverage is depicted in Figure A-10 in Appendix A and is provided in conjunction with this report.

2.4.2.5.1 Year 2001 Surveys

Aquatic invertebrate sampling was conducted during June and August 2001 in perennial stream reaches in Greens Canyon (Site 1), Cowboy Creek (Site 2 [lower] and Site 3 [upper]), Greens Hollow (Site 4), and an unnamed stream near White Mountain Cabin (Control Site). A total of 98 invertebrate taxa were identified in the 17 samples collected in 2001. Taxa from five functional feeding groups (shredders, scrapers, collector filterers, collector gatherers, and predators) were collected, with collector gatherers representing the highest number of taxa and individuals collected. The five dominant taxa collected consisted of Baetis, Turbellaria, Orthocladiinae, Pericoma, and Nemouridae, and the dominant families included Chironomidae, Baetidae, Psychodidae, and Nemouridae (not all invertebrates were identified to family). A complete list of taxa collected is included in Appendix B. Results of the 2001 survey effort are summarized below in Table 5. (Vinson 2002a.)

Table 5. Macroinvertebrate data from the Muddy Analysis Area. June and August 2001.

	Site 1 (QN)	Site 1 (QL)	Site 2 (QN)	Site 2 (QL)	Site 3 (QN)	Site 3 (QL)	Site 4 (QN)	Site 4 (QL)	Ctrl (QN)	Ctrl (QL)
June 2001										
Mean Abundance[1]	--	979	732	330	1614	785	1133	564	5052	1908
Taxa Richness (# distinct taxa)	--	26	34	24	33	27	40	33	38	40
Mean EPT[2] Abundance[1]	--	786	435	186	468	176	240	50	2329	877
EPT Taxa Richness (# EPT taxa)	--	11	13	11	9	9	9	5	19	18
Number of Unique Families	--	16	15	16	18	16	20	15	18	18
Shannon Diversity Index[3]	--	1.73	2.73	2.33	2.56	2.28	2.69	2.43	2.68	2.74
Simpson's Diversity Index[4]	--	0.30	0.09	0.13	0.12	0.16	0.12	0.15	0.10	0.09
Evenness[5]	--	0.51	0.68	0.70	0.60	0.58	0.55	0.55	0.70	0.69
Hilsenoff Biotic Index[6]	--	4.08	3.35	2.05	4.86	5.50	4.33	5.02	3.06	3.01
Richness-pollution intolerant taxa	--	7	4	5	2	4	2	1	8	9
Richness-pollution tolerant taxa	--	1	1	0	1	1	1	1	1	1
	Site 1 (QN)	**Site 1 (QL)**	**Site 2 (QN)**	**Site 2 (QL)**	**Site 3 (QN)**	**Site 3 (QL)**	**Site 4 (QN)**	**Site 4 (QL)**	**Ctrl (QN)**	**Ctrl (QL)**
August 2001										
Mean Abundance[1]	--	163	3004	1654	--	664	1801	959	25029	17550
Taxa Richness (# distinct taxa)	--	22	25	29	--	20	25	22	33	27
Mean EPT[2] Abundance[1]	--	42	2326	724	--	37	303	102	11409	7598
EPT Taxa Richness (# EPT taxa)	--	8	11	9	--	6	6	6	16	14
Number of Unique Families	--	14	11	12	--	10	12	12	17	15

Table 5. Macroinvertebrate data from the Muddy Analysis Area. June and August 2001.										
	Site 1 (QN)	Site 1 (QL)	Site 2 (QN)	Site 2 (QL)	Site 3 (QN)	Site 3 (QL)	Site 4 (QN)	Site 4 (QL)	Ctrl (QN)	Ctrl (QL)
Shannon Diversity Index[3]	--	2.33	1.96	2.24	--	1.36	2.27	1.98	2.48	2.44
Simpson's Diversity Index[4]	--	0.16	0.27	0.17	--	0.44	0.18	0.20	0.11	0.12
Evenness[5]	--	0.58	0.45	0.57	--	0.44	0.54	0.65	0.72	0.69
Hilsenoff Biotic Index[6]	--	4.16	2.68	4.38	--	1.63	4.68	3.74	2.43	2.30
Richness-pollution intolerant taxa	--	5	3	4	--	2	2	2	9	6
Richness-pollution tolerant taxa	--	1	1	1	--	1	1	1	1	1

QN = quantitative sample, QL = qualitative sample, Ctrl = control site.

Note: data in this table replaces that provided in Table 4 in the Cirrus Wildlife Surveys Year 2001-2002 Progress Report (February 2003).

[1] Mean Abundance is reported as number per square meter for quantitative samples and number per sample of unknown area for qualitative samples.

[2] EPT = Invertebrates from the orders Ephemeroptera, Plecoptera, and Trichoptera. These orders are commonly considered sensitive to pollution.

[3] Shannon Diversity Index is a measure of community structure defined by the relationship between the number of distinct taxa and their relative abundances. Higher values indicate greater diversity.

[4] Simpson's Diversity Index is also a measure of community structure defined by the proportion of taxa within the assemblage, giving little weight to rare taxa. Values range from 0 (low diversity) to 1 - 1/# taxa).

[5] Eveness is a measure of the distribution of taxa within a community. Values range from 0 to 1, and approach zero as a single taxa becomes more dominant.

[6] Hilsenoff Biotic Index values of 0-2 are considered clean, with little organic enrichment, 2-4 slightly enriched, 4-7 moderately enriched, and 7-10 polluted.

2.4.2.5.2 Year 2002 Surveys

Surveys for macroinvertebrates were conducted in May and September 2002. Sample periods were earlier and later in the season than in 2001 in order to sample during periods of greater water flow. In May, samples were collected at same sites sampled in 2001 with the exception of Site 1. Site 1 had no water in it in May 2002 so a new site, Site 1A, was placed upstream in Greens Canyon, about 100 meters above the point where the stream was no longer flowing. In September, samples were collected at the same sites sampled in May 2002 with the exception of Site 3. Site 3 had no water in it in September so a new site, Site 3A was placed downstream between Site 3 and Site 2 in Cowboy Creek (referred to as Middle Cowboy Creek), in a location with sufficient flow (see Figure A-10, Appendix A).

Both types of samples (quantitative and qualitative) were taken at Site 1A during May and only a qualitative sample in September because of low flow. Flow was sufficient to take both types of samples at Site 2 during May and September. Both types of samples were taken at Site 3 in May but no samples were taken at this site in September due to lack of water. Site 3A was sampled instead, and only a qualitative sample was collected due to low flow. Both types of samples were taken at Site 4 in May and none were collected in September because the site had completely dried up. The Control Site had a larger volume of water than the other sites thus both types of samples were easily obtained during both sample periods.

A total of 86 invertebrate taxa were identified in the 16 samples collected in 2002. Taxa from five functional feeding groups (shredders, scrapers, collector filterers, collector gatherers, and predators) were collected, with collector gatherers representing the highest number of taxa and individuals collected. The five dominant taxa collected consisted of Turbellaria, Baetidae, Orthocladiinae, Chironominae, and Pericoma, and the dominant families included Chironomidae, Baetidae, Psychodidae, and Tipulidae (not all invertebrates were identified to family). A complete list of taxa collected is included in Appendix B. Results of the 2002 survey effort are summarized below in Table 6. (Vinson 2002b.)

Table 6. Macroinvertebrate data from the Muddy Analysis Area. May and September 2002.

	Site 1A (QN)	Site 1A (QL)	Site 2 (QN)	Site 2 (QL)	Site 3 (QN)	Site 3 (QL)	Site 4 (QN)	Site 4 (QL)	Ctrl (QN)	Ctrl (QL)
May 2002										
Mean Abundance[1]	199	351	1966	1149	689	765	139	337	6117	2167
Taxa Richness (# distinct taxa)	15	28	22	28	17	13	10	17	23	28
Mean EPT[2] Abundance[1]	28	202	796	300	19	11	1	12	5222	1573
EPT Taxa Richness (# EPT taxa)	5	11	9	11	4	1	1	4	11	13
Number of Unique Families	10	13	11	14	9	7	5	10	16	15
Shannon Diversity Index[3]	1.48	2.43	1.96	2.30	1.87	1.43	0.92	1.87	2.04	2.25
Simpson's Diversity Index[4]	0.36	0.14	0.18	0.15	0.22	0.36	0.61	0.24	0.18	0.17
Evenness[5]	0.53	0.62	0.73	0.64	0.65	0.57	0.43	0.58	0.70	0.59
Hilsenoff Biotic Index[6]	5.83	4.64	4.80	5.40	5.77	2.83	5.84	5.86	3.62	3.64
Biotic Condition Index (BCI)[7]	56	63	59	56	49	47	52	49	125	123
Richness-pollution intolerant taxa	1	3	2	2	1	0	0	1	7	7
Richness - pollution tolerant taxa	1	1	1	1	1	1	1	1	1	1
	Site 1A (QN)	**Site 1A (QL)**	**Site 2 (QN)**	**Site 2 (QL)**	**Site 3A (QN)**	**Site 3A (QL)**	**Site 4 (QN)**	**Site 4 (QL)**	**Ctrl (QN)**	**Ctrl (QL)**
September 2002										
Mean Abundance[1]	--	264	1156	1374	--	1622	--	--	21540	13201
Taxa Richness (# distinct taxa)	--	17	32	36	--	28	--	--	30	29
Mean EPT[2] Abundance[1]	--	2	116	457	--	506	--	--	7889	1824
EPT Taxa Richness (# EPT taxa)	--	2	7	9	--	8	--	--	13	12
Number of Unique Families	--	8	16	18	--	10	--	--	20	17
Shannon Diversity Index[3]	--	1.60	2.48	2.53	--	2.26	--	--	2.56	2.44
Simpson's Diversity Index[4]	--	0.31	0.14	0.12	--	0.20	--	--	0.11	0.13
Evenness[5]	--	0.58	0.57	0.64	--	0.48	--	--	0.67	0.66

Table 6. Macroinvertebrate data from the Muddy Analysis Area. May and September 2002.										
	Site 1A (QN)	Site 1A (QL)	Site 2 (QN)	Site 2 (QL)	Site 3 (QN)	Site 3 (QL)	Site 4 (QN)	Site 4 (QL)	Ctrl (QN)	Ctrl (QL)
Hilsenoff Biotic Index[6]	--	0.48	4.63	3.82	--	4.18	--	--	1.92	2.93
Biotic Condition Index (BCI)[7]	--	49	59	60	--	60	--	--	105	107
Richness-pollution intolerant taxa	--	0	5	3	--	3	--	--	7	8
Richness - pollution tolerant taxa	--	1	1	1	--	1	--	--	1	1

QN = quantitative sample, QL = qualitative sample, Ctrl = control site.
[1-6] See definitions in Table 5.
[7] Biotic Condition Index = an index of stream quality, as defined in Vinson 2004.

2.4.2.5.3 Year 2003 Surveys

Surveys for macroinvertebrates were conducted in May and September 2003, at the same sites sampled in September 2002. Both types of samples (quantitative and qualitative) were taken at all sites during May. During September, only qualitative samples were taken at sites 1A and 2, because of low flow, and no samples were taken at site 4, which was dry. Site 3A and the Control Site had sufficient flow in September to take both types of samples.

A total of 87 invertebrate taxa were identified in the 16 samples collected in 2003. Taxa from five functional feeding groups (shredders, scrapers, collector filterers, collector gatherers, and predators) were collected, with collector gatherers representing the highest number of taxa and individuals collected. The five dominant taxa collected consisted of Orthocladiinae, Baetis, Turbellaria, Pericoma, and Chironominae, with Trombidiformes being very abundant also, and the dominant families included Chironomidae, Baetidae, Simuliidae, and Psychodidae (not all invertebrates were identified to family). A complete list of taxa collected is included in Appendix B. Results of the 2003 survey effort are summarized below in Table 7. (Vinson 2004.)

Table 7. Macroinvertebrate data from the Muddy Analysis Area. May and September 2003.										
	Site 1A (QN)	Site 1A (QL)	Site 2 (QN)	Site 2 (QL)	Site 3A (QN)	Site 3A (QL)	Site 4 (QN)	Site 4 (QL)	Ctrl (QN)	Ctrl (QL)
May 2003										
Mean Abundance[1]	6426	659	1634	663	2784	1674	2690	896	6338	4454
Taxa Richness (# distinct taxa)	19	24	30	27	37	39	21	20	35	42
Mean EPT[2] Abundance[1]	77	34	139	89	193	124	24	0	2161	2080
EPT Taxa Richness (# EPT taxa)	5	4	9	8	10	13	3	0	16	19
Number of Unique Families	10	11	16	14	17	20	10	8	19	19
Shannon Diversity Index[3]	1.69	1.79	1.67	1.95	2.07	1.90	1.21	1.38	2.46	2.36
Simpson's Diversity Index[4]	0.25	0.30	0.39	0.26	0.28	0.26	0.47	0.38	0.12	0.15
Evenness[5]	0.67	0.46	0.37	0.47	0.38	0.50	0.49	0.54	0.69	0.61

Table 7. Macroinvertebrate data from the Muddy Analysis Area. May and September 2003.										
	Site 1A (QN)	**Site 1A (QL)**	**Site 2 (QN)**	**Site 2 (QL)**	**Site 3A (QN)**	**Site 3A (QL)**	**Site 4 (QN)**	**Site 4 (QL)**	**Ctrl (QN)**	**Ctrl (QL)**
Hilsenoff Biotic Index[6]	5.27	3.86	4.62	3.76	4.35	3.58	6.84	6.72	3.25	2.96
Biotic Condition Index (BCI)[7]	108	99	102	110	95	95	82	79	113	110
Richness-pollution intolerant taxa	1	0	4	2	4	6	0	0	9	11
Richness-pollution tolerant taxa	1	1	1	1	1	1	1	1	1	1
	Site 1A (QN)	**Site 1A (QL)**	**Site 2 (QN)**	**Site 2 (QL)**	**Site 3A (QN)**	**Site 3A (QL)**	**Site 4 (QN)**	**Site 4 (QL)**	**Ctrl (QN)**	**Ctrl (QL)**
September 2003										
Mean Abundance[1]	--	279	--	309	1277	365	--	--	20168	14626
Taxa Richness (# distinct taxa)	--	26	--	21	28	21	--	--	38	35
Mean EPT[2] Abundance[1]	--	197	--	233	797	235	--	--	4917	4705
EPT Taxa Richness (# EPT taxa)	--	9	--	7	10	7	--	--	20	18
Number of Unique Families	--	13	--	10	13	9	--	--	20	20
Shannon Diversity Index[3]	--	1.99	--	1.38	1.85	1.47	--	--	2.55	2.50
Simpson's Diversity Index[4]	--	0.23	--	0.46	0.30	0.39	--	--	0.11	0.11
Evenness[5]	--	0.52	--	0.39	0.43	0.47	--	--	0.68	0.71
Hilsenoff Biotic Index[6]	--	3.16	--	2.11	2.36	2.69	--	--	2.62	3.21
Biotic Condition Index (BCI)[7]	--	118	--	111	93	96	--	--	108	104
Richness-pollution intolerant taxa	--	5	--	3	3	3	--	--	12	12
Richness-pollution tolerant taxa	--	1	--	0	1	1	--	--	1	1

QN = quantitative sample, QL = qualitative sample, Ctrl = control site.
[1-7] See definitions in Tables 5 and 6.

2.4.2.5.4 Survey Summary: 2001- 2003

A total of 126 invertebrate taxa were identified in the 49 samples collected over the 3-year sampling period (2001-2003). Taxa from five functional feeding groups (shredders, scrapers, collector filterers, collector gatherers, and predators) were collected, with collector gatherers representing the highest number of taxa and individuals collected for each year of sampling. The five dominant taxa collected consisted of Turbellaria, Orthocladiinae, Baetis, Pericoma, and Chironominae, and the dominant families included Chironomidae, Baetidae, Psychodidae, and Nemouridae (not all invertebrates were identified to family). A complete list of taxa collected is included in Appendix B. Average results for the 3 years of surveys are summarized below by season in Table 8. (Vinson 2004.)

Table 8. Macroinvertebrate data from the Muddy Analysis Area. Three-year averages by season (2001-2003).

	Season	Site 1 (QN)	Site 1 (QL)	Site 1A (QN)	Site 1A (QL)	Site 2 (QN)	Site 2 (QL)	Site 3 (QN)	Site 3 (QL)	Site 3A (QN)	Site 3A (QL)	Site 4 (QN)	Site 4 (QL)	Ctrl (QN)	Ctrl (QL)
Number of samples (# years)[8]	Spring	0	1	2	2	3	3	2	2	1	1	3	3	3	3
	Falls	0	1	0	2	2	3	0	1	1	2	1	1	3	3
Mean Abundance[1]	Spring	--	979	3313	505	1444	714	1152	775	2784	1674	1321	599	5836	2843
	Fall	--	163	--	272	2080	1112	--	664	1277	994	1801	959	22246	15126
Taxa Richness (# distinct taxa)	Spring	--	26	17	26	29	26	25	20	37	39	24	23	32	37
	Fall	--	22	--	22	29	29	--	20	28	25	25	22	34	30
Mean EPT[2] Abundance[1]	Spring	--	786	53	118	457	192	244	94	193	124	88	21	3237	1510
	Fall	--	42	--	100	1221	471	--	37	797	371	303	102	8072	4709
EPT Taxa Richness (# EPT taxa)	Spring	--	11	5	8	10	10	7	5	10	13	4	3	15	17
	Fall	--	8	--	6	9	8	--	6	10	8	6	6	16	15
Number of Unique Families	Spring	--	16	10	12	14	15	14	12	17	20	12	11	18	17
	Fall	--	14	--	11	14	13	--	10	13	10	12	12	19	17
Shannon Diversity Index[3]	Spring	--	1.73	1.58	2.11	2.12	2.19	2.22	1.85	2.07	1.90	1.61	1.89	2.39	2.45
	Fall	--	2.33	--	1.79	2.22	2.05	--	1.36	1.85	1.87	2.27	1.98	2.53	2.46
Simpson's Diversity Index[4]	Spring	--	0.30	0.31	0.22	0.22	0.18	0.17	0.26	0.28	0.26	0.40	0.26	0.13	0.14
	Fall	--	0.16	--	0.27	0.20	0.25	--	0.44	0.30	0.29	0.18	0.20	0.11	0.12
Evenness[5]	Spring	--	0.51	0.60	0.54	0.59	0.60	0.62	0.57	0.38	0.50	0.49	0.56	0.70	0.63
	Fall	--	0.58	--	0.55	0.51	0.54	--	0.44	0.43	0.47	0.54	0.65	0.69	0.68
Biotic Condition Index (BCI)[7,9]	Spring	--	--	82	81	81	83	49	47	95	95	67	64	119	117
	Fall	--	--	--	84	59	86	--	--	93	78	--	--	107	106
Hilsenoff Biotic Index[6]	Spring	--	4.08	5.55	4.25	4.26	3.74	5.32	4.17	4.35	3.58	5.67	5.87	3.31	3.20
	Fall	--	4.16	--	1.82	3.66	3.44	--	1.63	2.36	3.44	4.68	3.74	2.32	2.81
Richness-pollution intolerant taxa	Spring	--	7.0	1.0	1.5	3.3	3.0	1.5	2.0	4.0	6.0	0.7	0.7	7.7	9.0
	Fall	--	5.0	--	2.5	4.0	3.3	--	2.0	3.0	3.0	2.0	2.0	9.3	8.7
Richness-pollution tolerant taxa	Spring	--	1.0	1.0	1.0	1.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Fall	--	1.0	--	1.0	1.0	0.7	--	1.0	1.0	1.0	1.0	1.0	1.0	1.0

QN = quantitative sample, QL = qualitative sample, Ctrl = control site.

[1-7] See definitions in Tables 5 and 6.

[8] Site 1 was only sampled in 2001, site 1A in 2002 and 2003, site 3 in 2001 and May 2002, and site 3A in September 2002 and in 2003. Additionally, site 4 was dry in September 2002 and 2003. Quantitative samples could not be collected at some of the sites due to insufficient flow or lack of water.

[9] BCI was only calculated in 2002 and 2003. Total alkalinity and sulfate were used to calculate this index and were not measured in 2001.

2.4.3 Species of High Federal Interest

2.4.3.1 Migratory Birds

The species of high federal interest for the Uinta-Southwestern Utah coal production region of Utah and Colorado include 22 species of migratory birds. These species are listed below in Table 9 along with the general habitat types required, elevation range, and predicted occurrence.

Table 9. Migratory birds of high federal interest.

Species	Elevation Range (ft)[1]	Breeding Habitats[2]	Occurrence Expected[3]
Western bluebird	3,000-8,000	Open, riparian, or burned woodlands	Possible
Sandhill crane	3,000-10,000	Wetlands, freshwater margins	Possible during migration
Long-billed curlew	3,000-5,000	Prairies, grassy meadows near water	No
Bald eagle[4]	3,000-8,000	Rivers, lakes, reservoirs	Observed
Golden eagle[4]	3,000-14,000	Open mountain habitat	Observed
Peregrine falcon	3,000-10,000	Open forest and mountain habitat	Observed
Prairie falcon	3,000-14,000	Open mountain habitat, prairies	Observed
Cooper's hawk	3,000-10,000	Riparian woodlands, conifer, decid.	Observed
Ferruginous hawk	3,000-9,500	Grasslands, shrub-steppe	Possible
Great blue heron	3,000-9,000	Lakes, rivers, marshes	Possible
Merlin	3,000-9,000	Conifer, riparian woodlands, prairie	Possible
Scott's oriole	3,000-5,500[6]	Riparian woodlands, pinyon/juniper	Possible
Osprey	3,000-10,000	Rivers, riparian, lake	Possible
Burrowing owl	3,000-9,000	Grasslands, prairie, savanna	Possible
Flammulated owl[4]	6,000-10,000	Pine forest, mixed conifer/aspen	Observed
Mexican spotted owl[5]	5,500-9,000	Wooded steep-walled canyons	No
Band-tailed pigeon	5,000-9,000	Coniferous forests, pine, woodlands	Possible
Williamson's sapsucker	5,500-11,000	Montane conifer and aspen forests	Observed
Black swift	7,500-14,000	Montane forests, cliffs, waterfalls	Possible
Grace's warbler	5,000-7,500	Montane pine forests - southern UT	No
Lewis's woodpecker	3,000-8,000	Pine, mixed conifer, P/J, deciduous	No
Pileated woodpecker	- -	Conifer and deciduous forests	No

[1] Elevation range data is general - from Colorado GAP. Source: CDOW 2001.

[2] Sources: Ehrlich et al. 1988; NatureServe Explorer 2002; UCDC 2003; UDWR 1997.

[3] Expected occurrence based on known distribution of species, known or predicted habitat in project area (Utah Gap Analysis 1997 and 1999), county record, elevation range of species, and habitat requirements. No = occurrence not expected; Possible = low possibility of species occurring, and Observed = species observed in the project area.

[4] These species are addressed in more detail in additional sections of this report.

[5] The Mexican spotted owl is being surveyed in the analysis area under a separate contract. No owls have been observed to date and the probability of occurrence is very low.

[6] Dalton et al. 1990 record this species as usually occcurring in submontane habitats from 5,500 to 8,500 ft.

2.4.3.1.1 Survey Methods

Migratory bird surveys were conducted in the following general habitat types, both concurrent and in addition to other required surveys: riparian, grassland and forblands, sagebrush, mixed conifer, aspen and aspen mixed conifer, ponderosa pine, mahogany and mountain brush, limber pine, and pinyon pine/juniper. Greater emphasis was given to surveying the forested and sagebrush habitat types.

Considerable time was spent traversing coniferous and mixed-coniferous forests and riparian habitats during the breeding season while surveying for sensitive species. Extensive time was also spent traversing shrub-steppe environments during the breeding season while surveying for sage-grouse. Time surveying in grassland habitat in 2001 to 2002 was limited to those areas adjacent to sagebrush habitat, and to the grasslands traversed while traveling to other habitats. In 2003, survey effort specifically included grasslands.

A digital coverage was created in Excel for observations of species of high federal interest not addressed elsewhere in this document. Only nests, young, or observations of adults exhibiting nesting/territorial behavior were mapped. Observations made outside of the breeding season were not mapped. This coverage is depicted in Figure A-11 in Appendix A and is provided in conjunction with this report. See Figures A-3 and A-6 for depictions of flammulated owl responses to surveys and golden eagle nest sites, respectively.

2.4.3.1.2 Survey Results

Of the migratory bird species listed above, five are not expected to occur in the analysis area, ten have a possibility of occurring, and seven were observed in the project area during 2001-2003. The species observed include bald eagle, golden eagle, peregrine falcon, prairie falcon, Cooper's hawk, flammulated owl, and Williamson's sapsucker. Observations of bald eagles, flammulated owls, and golden eagles are discussed in sections 2.4.1.1, 2.4.1.4, and 2.4.2.1, respectively.

A pair of peregrine falcons was observed during the survey effort in 2002. The falcons were encountered while walking along the rim of Muddy Creek Canyon within the 2-mile buffer on the west side of the tract (see Figure A-11, Appendix A). The pair was exhibiting territorial behavior, and it was presumed that a nest was nearby within the cliff faces. One peregrine falcon was observed circling above an inactive golden eagle nest during UDWR aerial surveys in 2003. No falcons were observed in 2001.

Three known prairie falcon nests occur in the tract buffer and have been surveyed with helicopters intermittently by UDWR since 1998 (see Figure A-11, Appendix A). All three nests were surveyed with the assistance of Cirrus in 2002. Two were inactive and one was not found. None of the surveyed nests have been active or tended since 2001, at which time one was active. Over the six-year survey period, one of the nests was active twice and another nest was tended twice. The third nest was never recorded as either active or tended. In 2001, a prairie falcon was observed by Cirrus during pedestrian surveys (location unknown). One prairie falcon was observed across the canyon near Buzzard Bench during the 2002 aerial survey effort. No prairie falcons were observed in 2003.

An adult Cooper's hawk was observed in 2002 during a goshawk survey along the North Fork of Quitchupah Creek, in the southwest portion of the analysis area. It started vocalizing and flew in after goshawk calls were played. Habitat was a drainage bottom with spruce, aspen, and a few limber pines.

One female Williamson's sapsucker was observed while conducting three-toed woodpecker surveys in 2002. It was observed first on a north-facing embankment above a tributary of the North Fork Muddy. The embankment contained a mixture of spruce, fir, and aspen and snags. The sapsucker was then observed entering a nest tree. The nest was in a 14 inch dbh aspen snag within an old beaver pond site.

Although coniferous and mixed-coniferous forest, riparian habitats, and canyon edges were frequently traversed during the breeding season, no observations of band-tailed pigeon or black swift were made. The majority of the forested portions of the analysis area above 9,000 feet, thus it is possible that this habitat is above the elevation usually used by band-tailed pigeons. Although band-tailed pigeons have been recorded using coniferous forests, they are most closely associated with Gambel oak-pinyon pine habitat types in Utah (NatureServe Explorer 2002), which are lacking in the project area. Habitat mapped by UDWR as suitable for this species is over 4 miles west of the Muddy buffer boundary (UCDC 2003). The elevation of the analysis area is within the range of that used by black swifts, and there was a report of a swift west of Joe's Valley Reservoir in 1998. However, the black swift is considered extremely rare in Utah, and its breeding habitat is limited to wet cliff ledges behind waterfalls, which have not been observed in the analysis area. Western bluebirds were not observed, although they could potentially occur in the riparian areas in the analysis area. Merlins were not observed in coniferous forest or riparian habitats, and there are no records of merlins in Emery, Sevier, or Sanpete counties, and parts of the analysis area are above the upper elevation range used by this species.

Great blue herons were not observed in the survey areas. However, this species could potentially use habitat at Julius Flat Reservoir, Brush Reservoir, or some of the beaver ponds and associated wetlands located in the western and northwester portions of the tract buffer. Sandhill cranes could potentially use these areas too, but use would be associated with migration only, as breeding populations of this species are restricted to northeast Utah.

Survey efforts in shrub-steppe environments and grasslands resulted in no observations of burrowing owls or ferruginous hawk. Grasslands in the study area tend to be small and interspered with shrubs and may not provide enough open habitat for these species.

Survey efforts in pinyon-juniper habitats and riparian woodlands resulted in no observations of the Scott's oriole. These habitats are extremely limited in the analysis area, thus reducing the likelihood of this species presence. Furthermore, it is likely that this species inhabits elevations lower than those present in the analysis area.

2.4.4 Other Wildlife Species

2.4.4.1 Sage-grouse

Surveys for the greater sage-grouse consisted of visits to known lek sites and searches for grouse sign in suitable habitat that could potentially be used during the breeding season. Grouse sign was in the form of tracks, fecal and cecal pellets. Suitable habitat was defined as plains, foothills, and mountain valleys, where the predominant shrub species is sagebrush, of short to medium stature. Suitable habitat for sage-grouse exists in both tracts, and although populations have greatly declined, this species was historically abundant in the area. Additionally, 48 sage-grouse were transplanted to the southern portion of the Muddy analysis area by UDWR between 1987 and 1990.

2.4.4.1.1 Strutting Ground Surveys

UDWR has been annually monitoring the strutting ground utilized by reintroduced grouse on the Muddy tract since 1991. This ground, referred to as Wildcat Knolls, has received use by 3 to 20 cocks on a given year with the lowest numbers observed in 2003. Cirrus personnel assisted with the survey in April 2002 and 2003 and also observed three hens in the area in 2002. This lek site is currently the only one in the analysis area known to be active. In 2003, UDWR and Cirrus personnel also surveyed additional areas identified as potential lek sites by Cirrus in 2002, along the east side of Box Canyon and near Pines Knolls. UDWR observed two cocks and two hens between Box Canyon and the East Fork of Box

Canyon in early April, but the birds were not engaged in any lekking displays. No sage-grouse were observed near Pines Knolls. These two sites were revisited by Cirrus later in April but no grouse were observed.

2.4.4.1.2 Grouse Sign Surveys

Sagebrush habitat potentially suitable for sage-grouse was surveyed for sign by Cirrus. Priority was given to areas with historic grouse use and to those containing a good understory of grasses and forbs, although lesser quality habitat was also surveyed. Survey methods consisted of walking along closely spaced, parallel transects through sagebrush habitat and searching the ground for fecal and cecal pellets, feathers, and tracks. The majority of the survey effort took place in April 2002, although one area not visited at that time was surveyed in June 2002.

Digital coverages were generated to delineate the boundaries of survey areas, locations of abundant grouse sign, and the existing strutting ground within the tract. These coverages are depicted in Figure A-12, Appendix A, and are provided in conjunction with this report.

2.4.4.1.3 Survey Results

Surveys for sage-grouse sign within the Muddy analysis area took place from mid to late April in the following locations: Greens Hollow, The Pines, Julius Flat, the area from Wildcat Knolls north to the tip of Box Canyon, the area west of Box Canyon, and between Box Canyon and Greens Canyon. Additional surveys were conducted in early June between Box Canyon and East Fork Box Canyon.

There was no grouse sign observed at Greens Hollow or near Julius Flat reservoir, presumably because the sage in that area was very tall, with minimal understory grasses and forbs. Although the sagebrush was shorter between Greens Canyon and Box Canyon, only a few old piles of grouse pellets were found. As expected, abundant sage-grouse sign was found in the area around the Wildcat Knolls site, clear up to the intersection of FS roads 044 and 007. Further north from this intersection, on the west side of Box Canyon, there was very little grouse sign. One concentrated area of grouse use was found on the western portion of FS road 028 in The Pines. This area contained numerous patches of sagebrush that had been burned to increase cattle forage, and the grouse pellets were found on the edge between burned and unburned areas. The sage-grouse were probably using the taller sagebrush for roosting and the burned areas for foraging. The most extensive sign of sage-grouse outside of the Wildcat Knolls area was between the East Fork and main fork of Box Canyon. Numerous piles of fecal and cecal pellets and a few feathers were found at the junction of and between FS roads 318 and 058. In addition, 12 roosting adults were flushed near the head of Box Canyon during this survey effort. (See Figure A-12, Appendix A.) South of this area, near Box Pond, SUFCO Mine personnel also reported seeing over a dozen sage-grouse (adults and chicks) in June, presumably looking for water.

2.4.4.2 Amphibians

Surveys for amphibians were conducted in suitable breeding habitats in the Muddy Creek analysis area in 2001, 2002, and 2003. Suitable habitat was defined as natural ponds and wetlands, and pooled habitat adjacent to streams. Man-made water holes and reservoirs containing emergent vegetation were also considered suitable habitat. Potential pond sites were identified from aerial photographs and through field reconnaissance.

2.4.4.2.1 Survey Methods

Amphibian encounter surveys were conducted in June and July 2001 within the analysis area by walking around the periphery of ponds and pools and scanning the area for amphibian adults, larvae, and/or eggs. Visual scans for amphibians were also made in streams where habitat conditions looked favorable. In

addition, aural observations of the more vocal amphibian species were made during late afternoon and in the evening.

Additional amphibian habitat was assessed during the pond monitoring effort conducted for the Utah School and Institutional Trust Land Administration (SITLA) in September 2002. A total of 11 ponds were surveyed within the analysis area. Of these, five were natural basins and six were man-made. The majority of natural basins were dry during the survey effort. In addition to the survey parameters recorded for SITLA, the ponds were visually scanned for the presence of amphibians, and were assessed for habitat suitability (water depth, presence of emergent vegetation, and livestock disturbance).

Ponds that were dry during the 2001 and 2002 surveys and appeared to offer suitable habitat for amphibians were revisited in early spring of 2003, as soon as they became accessible, to survey for amphibians while these ponds still held water. Ponds where boreal toads had been observed in 2001 were also revisited in 2003, to attempt to confirm those sightings. Additional sites identified from aerial photos were also visited.

A digital coverage was generated for all natural ponds identified within the analysis area and for locations of identified amphibians. This coverage represents a comprehensive coverage of all natural ponds observed and/or surveyed for amphibians between 2001 and 2003. The natural pond coverage is depicted in Figure A-13, Appendix A and is provided in conjunction with this report. This coverage, used in combination with the stock pond coverage and wetland coverage (provided with the Surface and Ground Water and Vegetation Resources Technical Reports prepared for the Muddy Creek Tract, respectively), represents a relatively comprehensive coverage of all potential amphibian habitat in the analysis area.

2.4.4.2.2 Survey Results

Four species of amphibians were observed in the analysis area in 2001. Chorus frogs were found in a series of ponds in the western portion of the 2-mile buffer, from White Mountain Cabin to Julius Flat Reservoir and in one pond just inside the tract. Chorus frogs were also heard calling in late June at Julius Flat Reservoir. Tiger salamander larvae were abundant in a pond in The Pines, in the eastern portion of the 2-mile buffer, and were also present in four ponds in the western part of the buffer zone and in one pond just inside the tract. Boreal toads larvae were found in two ponds in the western part of the buffer zone, between White Mounatin Cabin and Julius Flat Reservoir. Great Basin spadefoot toads (*Scaphiopus intermontanus*) were potentially heard calling in the southeast corner of the buffer zone from a cattle pond and a stream channel at the bottom of Box Canyon. However, the elevation of the analysis area may be above that used by this species. Very few amphibians were found inside of the tract boundary, proper, presumably because very little amphibian breeding habitat is present.

No amphibians were observed during the 2002 survey effort, presumably because it was conducted after the breeding season and the majority of the suitable habitat was dry. However, chorus frogs were heard calling at Julius Flat Reservoir. Ponds that were considered suitable amphibian habitat were recorded for future surveys during the breeding season.

In 2003, chorus frogs were observed at eight new ponds and at two ponds where they had already been observed in 2001, and tiger salamanders were observed at three new ponds and at one pond where they had been observed in 2001. All those ponds were located in the western part of the buffer zone. No boreal toads or Great Basin spadefoot toads were observed in 2003.

In summary, over the three-year survey period, chorus frogs were observed at fifteen ponds, tiger salamanders at nine ponds, and boreal toads at two ponds. Additionally, Great Basin spadefoot toads were possibly heard at two locations. Most of those ponds were located in the western portion of the

buffer zone, with the exception of the two potential spadefoot toad observations and one salamander pond located in the southeast part of the buffer, and one pond located inside the tract, near its western edge.

2.4.4.3 Reptiles

No formal surveys for reptiles were conducted in the Muddy analysis area as no areas were identified that would be directly disturbed by mining facilities and mining roads, and facilities have already been built. However, Cirrus personnel traversed abundant habitat at all hours of the day, and performed informal searches on and under rocks and ledges in rock outcrops and sandstone formations. Five species of reptiles were observed incidentally during field visits in the analysis area (eastern fence lizard, western terrestrial garter snake, tree lizard, sagebrush lizard, and short-horned lizard), between 2001 and 2003. Overall, very few reptiles were observed.

2.4.4.4 Small mammals

No surveys were required for small mammals. Twenty-two species of mammals, including sixteen small mammals, were observed incidentally in the Muddy analysis area between 2001 and 2003 (See Appendix C). A few additional chipmunks, ground squirrels, and pocket gophers were observed but not identified to species. For the purpose of this analysis, small mammals include shrews, bats, small carnivores (Procyonidae, Bassariscidae, and Mustelidae, with the exception of the wolverine), rodents, and lagomorphs. Ungulates and large carnivores (Ursidae, Canidae, Felidae, and the wolverine) will not be addressed in this section.

Since no trapping was conducted, and since the nocturnal nature of many small mammals makes them difficult to observe, probability-of-occurrence analysis was conducted to determine what additional species could potentially occur in the analysis area. Factors used to determine probable occurrence included habitat requirements reported in the literature, habitat presence in the project area, and documented occurrence, through surveys, historic records, and incidental observations of individuals in or near the analysis area. Results of this analysis are discussed generally below, by habitat type, and depicted in Appendix D.

According to Dalton et al. (1990), 69 species of small mammals are likely present in the Wasatch Plateau area, where the analysis area is located. These species include 5 shrews, 15 bats, 9 small carnivores, 34 rodents, and 6 lagomorphs. However, based on the UDWR inventory of sensitive species in Utah (UDWR 1997), two of these species are not expected to occur in the project area: the red bat and the river otter. On the other hand, two additional species, the spotted bat and the grasshopper mouse, were observed by Cirrus personnel in the analysis area, and one more species, the Hopi chipmunk, could also occur there, based on predicted habitat maps found on the UDWR web site (Utah Gap Analysis 1997). This would bring the total number of small mammal species potentially occuring in the analysis area to 70 (5 shrew, 15 bats, 8 small carnivores, 36 rodents, and 6 lagomorphs), of which 16 were observed during the survey effort.

A comprehensive list of small mammal species and their habitat requirements and relative abundance in the Wasatch Plateau area is presented in Appendix C. County records of species occurrence, the presence of predicted suitable habitat, and the expected occurrence of individual species in the analysis area are also depicted. Species were included in the table if they were mentioned as occurring in the Wasatch Plateau area by Dalton et al. (1990), or if predicted habitat for these species was present on or near the analysis area, according to the maps on the UDWR web site (Utah Gap Analysis 1997), or if records of the species existed in one or more of the counties in which the analysis area was located. However, some of these species are not expected to occur in the Muddy analysis area proper. For instance, Utah prairie dogs are present in Sevier County but are not expected to occur in the analysis area due to lack of habitat.

Predicted habitat for the dwarf shrew exists in the analysis area but this species is seemingly very rare, known from only four localities in Utah, and is not expected to occur in the Wasatch Plateau area.

Various habitat types are represented in the analysis area. General types include sagebrush, pinyon-juniper, mahogany and mountain brush, grassland and forbland, aspen and aspen-mixed conifers, mixed conifers, ponderosa pine, limber pine, rock outcrops and barren areas, and riparian areas, wetlands, and reservoirs. Some wildlife species may occur in only one particular habitat type, while others may use a wide variety of habitats. Riparian and wetland areas are used by the highest number of wildlife species but represent only a very small proportion of the habitat in the analysis area. A general description of species that use each habitat type follows.

Sagebrush is one of the most widespread and abundant habitat types in the analysis area. Small mammal species using sagebrush on the Wasatch Plateau include the least chipmunk, Great Basin pocket mouse, long-tailed vole, meadow vole, black-tailed jackrabbit, white-tailed jackrabbit, desert cottontail, and mountain cottontail. Both species of jackrabbits and the mountain cottontail were observed in the analysis area. The desert cottontail occurs at lower elevations than the mountain cottontail, generally below 6,000 feet. Since the analysis area is above 6,000 feet, most cottontails present in the area are likely to be mountain cottontails.

Pinyon-juniper habitat type is rare in the analysis area. Small mammal species found in this habitat on the Wasatch Plateau include the cliff chipmunk (which was observed in the analysis area), Hopi chipmunk, Great Basin pocket mouse, canyon mouse, and pinyon mouse. The ringtail could also potentially occur, in Muddy Creek Canyon.

Mahogany and mountain brush represent the most abundant habitat type in the analysis area. Species associated with this habitat on the Wasatch Plateau include the spotted skunk, cliff chipmunk, brush mouse, canyon mouse, and mountain cottontail. The cliff chipmunk and mountain cottontail were observed in the analysis area.

Grassland/forbland habitats are relatively common in the analysis area, occurring primarily in patches adjacent to pinyon-juniper, and sagebrush habitat types. Small mammals found in these habitats on the Wasatch Plateau include the badger, yellow-bellied marmot, Uintah ground squirrel, least chipmunk, northern pocket gopher, plains pocket mouse, Great Basin pocket mouse, long-tailed vole, montane vole, meadow vole, western jumping mouse, black-tailed jackrabbit, and white-tailed jackrabbit. The badger, yellow-bellied marmot, Uintah ground squirrel, northern grasshopper mouse, both species of jackrabbits, and an unidentified pocket gopher species were observed in the analysis area.

The aspen and aspen-mixed conifer habitat type is common in the western half of the analysis area. Small mammal species using those habitats include the beaver, the porcupine, and the snowshoe hare, all of which were observed in the analysis area.

Mixed conifers (mostly Douglas fir, subalpine fir, Englemann's spruce) represent a moderate component of the analysis area and are associated primarily with the perennial drainages. Typical small mammal species inhabiting coniferous forests on the Wasatch Plateau include the northern flying squirrel, the red squirrel, the porcupine, and the snowshoe hare. The Uintah chipmunk is found in openings in coniferous forests or at forest edges. Most of these species were observed in the analysis area, with the exception of the northern flying squirrel.

Ponderosa pine represents a minor component in the analysis area, occurring primarily in the southeast portion. Limber pine is even less abundant, occurring only in small, localized areas. Small mammals species using these two habitats on the Wasatch Plateau primarily include generalist species that can be

found in a variety of other habitats as well including the cliff chipmunk (observed in the analysis area), least chipmunk, northern pocket gopher, deer mouse, and long-tailed vole.

Rock outcrops and barren areas are rare in the analysis area. Several small mammals use these habitat features on the Wasatch Plateau. Species observed in the analysis area include the yellow-bellied marmot, golden-mantled ground squirrel, cliff chipmunk, Uintah chipmunk, bushy-tailed woodrat, and mountain cottontail. The spotted bat uses cliffs with rock crevices for roosting and was heard vocalizing at night. The ringtail, spotted skunk, rock squirrel, Hopi chipmunk, desert woodrat, canyon mouse, and pika could also occur in this habitat type.

Riparian areas, wetlands, and reservoirs are scarce in the analysis area but are used by the highest number of wildlife species. These habitats are present around and south of Julius Flat Reservoir, in Muddy Creek Canyon and associated tributaries, and along the North Fork of Quitchupah Creek. Typical riparian or wetland species found on the Wasatch Plateau include the masked shrew, northern water shrew, vagrant shrew, ringtail, raccoon, ermine, mink, beaver, western harvest mouse, western jumping mouse, long-tailed vole, meadow vole, water vole, and muskrat. Of these species, only the beaver was actually seen in the analysis area, but the other species are also expected to occur there. Most bat species also forage near water.

2.4.4.5 Non-game birds

No surveys were required for non-game birds. A list of bird species observed was compiled from incidental observations made during field visits to the study area in spring, summer, and fall 2001-2003. This list is presented in Appendix C. Cirrus personnel identified 90 species of birds in the Muddy analysis area, including 84 non-game birds and 6 game birds. Unidentified flycatchers and vireos were also observed.

A probability-of-occurrence analysis was conducted to determine what additional non-game bird species could potentially occur in the analysis area. Factors used to determine probable occurrence included habitat requirements reported in the literature, habitat presence in the project area, and documented occurrence, through surveys, historic records, and incidental observations of individuals in or near the analysis area. Results of this analysis are discussed generally below by habitat types described in section 2.4.4.4, and are depicted in Appendix E.

According to the information presented in Dalton et al. (1990), 201 species of non-game birds frequent the Wasatch Plateau area, excluding accidental species that are not normally found in the area. This includes 69 yearlong residents, 92 summer residents, 8 winter residents and 32 transients. Yearlong and summer residents are species that breed in the area (161 species total), winter residents breed in northern regions and only spend the winter in the area, and transients pass through the area during spring and/or fall migrations and do not remain in the area for any extended period of time. Nine of these species are unlikely to occur in the project area due to lack of suitable habitat or because the project area is outside of their range. On the other hand, six additional species were observed by Cirrus personnel in the analysis area or its vicinity, and five more could potentially be present there, based on the predicted habitat maps from the UDWR web site (Utah Gap Analysis 1997 and 1999). This brings the total number of non-game birds potentially present in the analysis area to 203, of which 84 were actually observed during the survey effort.

Some of these species, such as shorebirds associated with mudflats, are unlikely to be present on the coal tract itself but may occur locally in the buffer zone. Julius Flat Reservoir, located near the western edge of the Muddy tract buffer, has cobbly shores and does not offer any habitat for species foraging in the mud when water level is high. During late summer and fall, however, water level recedes and mudflats

may become exposed. Migratory shorebird could potentially use the reservoir during fall migration. However, the only shorebird species we observed there was the spotted sandpiper.

A comprehensive list of non-game bird species and their habitat requirements, seasonal status, and relative abundance in the Wasatch Plateau area is presented in Appendix E. Upland game birds, waterfowl, and pigeons/doves were considered to be game birds and are not included in the table. Five species of upland game birds, 20 waterfowl species (10 of them transient) and 3 pigeon/dove species are also present in the Wasatch Plateau area.

Non-game bird species observed in sagebrush habitat in the analysis area included the turkey vulture, golden eagle, common poorwill, broad-tailed hummingbird, gray flycatcher, sage thrasher, and vesper sparrow. The Brewer's sparrow was also observed, even though this species was listed by Dalton et al. (1990) as not known to inhabit the Wasatch Plateau area . The rough-legged hawk is expected to occur in this habitat during winter but most of the analysis area is usually inaccessible in that season due to deep snow or mud making the roads undriveable.

Species observed in pinyon-juniper habitat included the gray flycatcher, ash-throated flycatcher, western scrub jay, pinyon jay, green-tailed towhee, and gray vireo (which was not listed by Dalton et al. (1990) as present in the Wasatch Plateau area). The bushtit, plain titmouse, blue-gray gnatcatcher, Bewick's wren, black-throated gray warbler, and Virginia's warbler could also occur in this habitat in the analysis area.

Species commonly occurring in mahogany and mountain brush on the Wasatch Plateau include the broad-tailed hummingbird, the dusky flycatcher, the western scrub jay, the black-billed magpie, the bushtit, the Virginia's warbler, the dark-eyed junco, and the spotted towhee. Of these, the broad-tailed hummingbird, western scrub jay, black-billed magpie, dark-eyed junco, and spotted towhee were observed in the analysis area, as well as unidentified flycatchers.

Species observed in grassland and forbland habitats in the analysis area included the turkey vulture, prairie falcon, short-eared owl, common poorwill, vesper sparrow, and western meadowlark, even though this last species was not listed as present on the Wasatch Plateau by Dalton et al. (1990). Other species potentially using these habitats in the analysis area include the northern harrier, rough-legged hawk (in winter), and horned lark. We surveyed some of the grasslands in the analysis area for burrowing owls but did not find any. Grasslands in the analysis area may not be open enough for this species, as most of them are small and interspersed with shrubs.

Aspen and aspen-mixed conifer habitats in the analysis area are used by the Cooper's hawk, northern goshawk, flammulated owl, broad-tailed hummingbird (near openings), northern flicker, downy woodpecker, hairy woodpecker, Williamson's sapsucker, red-naped sapsucker, olive-sided flycatcher, western wood-pewee, violet-green swallow, black-capped chickadee, red-breasted nuthatch, brown creeper, warbling vireo, yellow-rumped warbler, orange-crowned warbler, western tanager, and dark-eyed junco. The white-breasted nuthatch and solitary vireo were not observed but are also expected to occur in that habitat in the study area.

Mixed conifers provide habitat for the Cooper's hawk, northern goshawk, great horned owl, flammulated owl, northern saw-whet owl, broad-tailed hummingbird (near openings), three-toed woodpecker, hairy woodpecker, Williamson's sapsucker, red-naped sapsucker, olive-sided flycatcher, western wood-pewee, tree swallow, violet-green swallow, Steller's jay, Clark's nutcracker, gray jay, mountain chickadee, red-breasted nuthatch, brown creeper, ruby-crowned kinglet, hermit thrush, Townsend's solitaire, yellow-rumped warbler, western tanager, dark-eyed junco, chipping sparrow, pine siskin, and pine grosbeak. Additional species that were not observed but are expected to occur in this habitat include the cordilleran

flycatcher, white-breasted nuthatch, golden-crowned kinglet, Swainson's thrush, Cassin's finch, and red crossbill. The Townsend's warbler could occur here during migrations.

Species observed in ponderosa pine included the flammulated owl, northern flicker, hairy woodpecker, brown creeper, and pine grosbeak. The pygmy nuthatch, solitary vireo, and Cassin's finch are also likely to be present in this habitat in the study area and the Williamson's sapsucker could occur in this habitat also (it was observed in the analysis area in a different habitat).

Species associated with rocky outcrops or barren areas included the golden eagle, peregrine falcon, prairie falcon, white-throated swift, canyon wren, and rock wren. The black rosy-finch and grey-crowned rosy-finch could also occur in the higher portions of the analysis area, in the western part of the Muddy buffer.

Of all habitats, riparian areas, wetlands, and reservoirs are used by the highest number of bird species. Some species use almost exclusively these habitats while others spend part of their time in other habitats. Most transient species use these habitats during migrations, including loons, grebes, shorebirds, waterfowl, gulls, and warblers. Two reservoirs are present in the Muddy buffer (Julius Flat Reservoir and Brush Reservoir), as well as various ponds and several perennial streams. Typical species using riparian areas, wetlands, or reservoirs in the analysis area include the sora rail, spotted sandpiper, cliff swallow, tree swallow, American dipper, MacGillivray's warbler, yellow warbler, and song sparrow. Five bald eagles were also observed along Cowboy Creek on the Muddy Tract in November 2003, as mentioned earlier in this report. The common loon, western grebe, pied-billed grebe, American white pelican, American coot, common snipe, great blue heron, California gull, belted kingfisher, barn swallow, bank swallow, northern rough-winged swallow, willow flycatcher, Wilson's warbler, and lazuli bunting were not observed but could also occur in the study area, as well as a variety of transient shorebirds.

3.0 Results and Discussion

This section provides background information necessary to assess potential impacts to terrestrial and aquatic wildlife that could occur as a result of implementing the action alternatives. The potential and/or known occurrence and habitat requirements for four categories of wildlife are discussed. The categories of wildlife addressed include the following: (1) federally listed and proposed endangered, threatened, and candidate species and Forest Service sensitive species (TEPS), (2) management indicator species (MIS), (3) species of high federal interest, and (4) other wildlife species not addressed in the previous categories, including fishes, blue grouse, amphibians, reptiles, small mammals, and non-game birds.

3.1 Description of the Affected Environment

3.1.1 Aquatic and Terrestrial Habitat

The analysis area is comprised of the Muddy coal tract (~8,645 acres) and the 2-mile buffer surrounding the tract (~28,205 acres), for an approximate total of 36,850 acres. The majority of the impacts associated with mining would be associated with the tract, although potential impacts could occur up to approximately 0.25 miles outside of the tract.

Ten wildlife habitat types are used in this analysis, of which one is aquatic and the rest terrestrial. The digital coverage of vegetation types for the MLNF (Forest Service 2002a) was used as a guide to define these types, and similar vegetation cover types in this coverage were consolidated. A brief description of habitat types used in this analysis follows. Further discussion of habitat types can be found in the

Vegetation Resources Technical Report prepared for the Muddy Tract. Streams were not categorized in the MLNF digital coverage, so they are described separately under aquatic habitat.

3.1.1.1 Aquatic Habitat

The primary perennial streams in the analysis area include Muddy Creek, North and South Forks of Muddy Creek, Horse Creek, Meadow Gulch, Box Canyon, East Fork Box Canyon, The Box, and the North Fork of Quitchupah Creek. In addition, perennial flow is present intermittently in portions of Cowboy Creek, Greens Hollow, and Greens Canyon. Of these streams, only portions of Muddy Creek and its north and south forks, The Box and Box Canyon, Cowboy Creek, Greens Hollow, and Greens Canyon occur within the coal tract boundary. Most streams in the analysis area are intermittent and do not provide good quality fish habitat. Intermittent streams are unlikely to contain cutthroat trout or other fish species. A complete list of perennial streams in the analysis area is included in the Surface and Ground Water Technical Report prepared for the Muddy Creek Tract.

The analysis area contains a minor component of riparian habitat. This includes wetlands, dry and wet meadows, willow and tree dominated riparian areas, and lakes, ponds, and reservoirs. Springs and seeps are also present. Combined, these habitats comprises less than one percent of the analysis area. However, these habitats are important for a variety of wildlife species, as most wildlife use riparian areas for at least some part of their life cycle. The extent of wetlands in the analysis area is detailed in the Vegetation Resources Technical Report prepared for the Muddy Creek Tract.

3.1.1.2 Terrestrial Habitat

The analysis area contains a variety of terrestrial habitats, including sagebrush, pinyon-juniper, mahogany and mountain brush, grassland and forbland, aspen and aspen-mixed conifers, mixed conifers, ponderosa pine, limber pine, and rock outcrops and barren areas.

Mahogany and mountain brush constitute the most abundant habitat type, occurring throughout the analysis area (27 percent). Sagebrush is the second most widespread and abundant habitat type in the analysis area, comprising roughly 21 percent of the area. The aspen and aspen-mixed conifer habitat type is common on the western half of the analysis area, comprising roughly 16 percent of the area. Grassland/forbland habitats are relatively common in the analysis area (15 percent of the area), occurring primarily in patches adjacent to pinyon-juniper and sagebrush habitat types. Mixed conifers (mostly Douglas fir, subalpine fir, Englemann's spruce) represent a moderate component of the analysis area (about 8 percent) and are associated primarily with the perennial drainages. Ponderosa pine represents a minor component in the analysis area (about 4 percent), occurring primarily in the southeast portion, outside of the tract. The pinyon-juniper and limber pine habitat types are rare in the analysis area (about 2 percent each), occurring mostly outside the tract. Rock outcrops and barren areas are also rare in the analysis area (about 2 percent), being limited primarily to the canyon walls of the Muddy drainage.

3.1.2 TEPS

The FWS annual list of federally listed and proposed endangered, threatened, and candidate species and habitat in Utah by County (FWS 2002) indicates that nine threatened or endangered wildlife species of concern and one candidate for listing could potentially occur in Emery, Sanpete, and/or Sevier counties. The Intermountain Region list of proposed, endangered, threatened, and sensitive species known or suspected distribution by Forest (Forest Service 2003b) indicates that ten Forest Service Sensitive species could occur on the MLNF. These species and their status are depicted in Table 10.

Table 10. Federally listed threatened and endangered and candidate species and Forest Service sensitive species potentially occurring on the MLNF in Emery, Sanpete, and/or Sevier counties.	
Species	**Status**
Fishes	
Bonytail (*Gila elegans*)	Endangered (Emery County)
Colorado Pikeminnow (*Ptychocheilus lucius*)	Endangered (Emery County)
Humpback Chub (*Gila cypha*)	Endangered (Emery County)
Razorback Sucker (*Xyrauchen texanus*)	Endangered (Emery County)
Colorado River Cutthroat Trout (*Oncorhynchus clarki pleuriticus*)	Sensitive
Bonneville Cutthroat Trout (*Oncorhynchus clarki utah*)	Sensitive
Birds	
Bald Eagle (*Haliaeetus leucocephalus*)	Threatened (Emery, Sanpete, and Sevier counties)
Mexican Spotted Owl (*Strix occidentalis lucida*)	Threatened (Emery County)
Southwestern Willow Flycatcher (*Empidonax trailii extimus*)	Endangered (Sevier County)
Western Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*)	Candidate (Emery, Sanpete, and Sevier counties)
Northern Goshawk (*Accipiter gentilis*)	Sensitive
Flammulated Owl (*Otus flammeolus*)	Sensitive
Peregrine Falcon (*Falco peregrinus*)	Sensitive
Three-Toed Woodpecker (*Picoides ridactytus*)	Sensitive
Greater Sage-Grouse (*Centrocercus urophasianus*)	Sensitive
Mammals	
Black-Footed Ferret (*Mustela nigripes*)	Endangered (Emery County)
Canada Lynx (*Lynx canadensis*)	Threatened (Sanpete County)
Utah Prairie Dog (*Cynomys parvidens*)	Threatened (Sanpete, and Sevier counties)
Spotted Bat (*Euderma maculatum*)	Sensitive
Western Big-Eared Bat (*Corynorhinus townsendii pallescens*)	Sensitive
Amphibians	
Spotted Frog (*Rana luteiventris*)	Sensitive

Of the species listed in Table 10, the yellow-billed cuckoo, southwestern willow flycatcher, black-footed ferret, Utah prairie dog, and Bonneville cutthroat trout are not predicted to occur in the analysis area and are not analyzed in this document. The remaining species could potentially occur in the analysis area and are addressed in this document.

The yellow-billed cuckoo is not addressed because the analysis area is above the elevational range of this species. The southwestern willow flycatcher is not addressed because the analysis area does not contain suitable habitat and the known distribution of this species does not overlap the Ferron Ranger District or other portions of the northern region of the MLNF (Utah Gap Analysis 1997). Furthermore, two years of surveys on the MLNF have failed to locate this species. The black-footed ferret is not addressed because predicted habitat does not occur in the analysis area (Utah Gap Analysis 1997), and this species is presumed extirpated from all but the eastern portion of Utah. The Utah prairie dog is not addressed

because suitable habitat does not occur in the analysis area. Suitable habitat is present below the tract buffer, near the town of Emery, however, the last record of this species in this area was in 1929 (Utah Gap Analysis 1997). The Bonneville cutthroat trout is not addressed because the analysis area is outside of the geographical range for this species.

TEPS Fish

Habitat requirements and life history characteristics of the species present within the analysis area or in the vicinity of it are described below. Special emphasis is given to TEPS. Within the analysis area, cutthroat trout is the only species listed as sensitive by the FWS and the State of Utah. No other TEPS are present within the analysis area. However, Muddy Creek flows into the Colorado River, which provides habitat to four endemic endangered species, including the bonytail, Colorado pikeminnow, humpback chub, and razorback sucker. Habitat and life history characteristics of these federally listed species are discussed briefly, as their habitat range is adjacent to the analysis area and impacts to water quality in the Muddy Creek drainage could potentially affect water quality in the Muddy Creek drainage could potentially affect water quality in the Colorado River.

The results of fish surveys conducted on perennial streams by the UDWR indicated that native cutthroat trout were present in Muddy Creek and the South Fork of Muddy Creek. Cutthroat were also observed incidentally on the North Fork of Muddy, but formal surveys have not yet occurred there. This cutthroat trout is thought to be of the Colorado River subspecies based on their known distribution in Utah. No fish were observed at the North Fork of Quitchupah Creek.

3.1.2.1 Bonytail

The bonytail is a member of the minnow family (Cyprinidae) similar to the humpback chub. The historic range of this species encompassed the mainstem and large tributaries of the Colorado River. The distribution and abundance of bonytail have been reduced greatly due to flow depletions, habitat loss and alteration, predation, and competition with exotic species. In hatcheries, spawning starts at temperatures of 20 °C. Eggs hatch 4 to 7 days after fertilization. Spawning is now rare in natural environments. However, they spawn during the spring and summer over gravel substrates, and they seem to prefer eddys and pools rather than swift currents. They are opportunistic feeders with an omnivorous diet that includes insects, zooplankton, algae, and higher plant matter (Sigler and Sigler 1996).

3.1.2.2 Colorado Pikeminnow

Native to the Colorado River system, the Colorado pikeminnow (formerly known as the Colorado squawfish) is the largest American minnow. This species occurs in warm, swift waters of large rivers in the Colorado Basin. However, they can tolerate a wide temperature range from 10°C in winter to more than 30°C in the summer. They are adapted to rivers with seasonally variable flow, high silt loads, and turbulence. Adults are migratory and inhabit pools and eddies near the main current while juveniles prefer backwater areas. Spawning occurs during spring and summer over riffle areas with grabble or cobble substrate. These fishes are primarily piscivorous, but small individuals also feed on insects and other invertebrates. This species has declined drastically due to stream alteration and habitat fragmentation caused by the construction of dams, irrigation dewatering, and the introduction of competitive and predatory non-native fishes. In addition, the size and number of backwaters and sloughs used for nursery and resting areas have decreased due to channelization below dams, and the natural cycle of flood and drought has been replaced by stable discharges and water levels (Sigler and Sigler 1996).

3.1.2.3 Humpback Chub

The humpback chub is a member of the Cyprinidae family, native to the upper Colorado River. Severe population declines of this species have occurred due to the alteration of streams, which have lead to changes in turbidity, volume, current velocity, and water temperature. In addition, this fish has also been affected by predation and competition with introduced fish species, pollution and eutrophication,

parasitism, changes in food sources, and fishing pressure. Fast currents and deep water over substrates of sand, silt, boulder, and bedrock have been associated with this species. Spawning occurs during spring and summer in shallow, backwater areas, with cobble substrate. Juveniles remain in these waters until they are large enough to move into the white-water areas (Sigler and Sigler 1996).

3.1.2.4 Razorback Sucker

The razorback sucker is a species native to the Colorado River system that has been greatly impacted by competition and predation from nonnative fish species, as well as by changes in natural flow and temperature regimes. This fish feed on algae, zooplankton, and other aquatic invertebrates. They occur in medium to large rivers with swift turbulent waters, as well as in slow backwater habitats and impoundments. Spawning occurs from February to June. Limited numbers of this fish species persist (Sigler and Sigler 1996). The largest current concentration of razorback suckers can be found in the Upper Green River and lower Yampa River (Tyus 1987). They also occur in small numbers in the Grand Valley area of the Colorado River (Osmundson and Kaeding 1991).

3.1.2.5 Colorado River Cutthroat Trout

The following description is based on the summary of habitat requirements and life history characteristics presented by Lentsh and Converse (1997). The Colorado River cutthroat trout (CRCT) is a subspecies of the cutthroat trout that is native to the upper Colorado River drainage of Utah, Wyoming, Colorado, Arizona, and New Mexico. This species is rare within its historic range. Habitat loss, predation, competition with non-native species, and hybridization have contributed to its population decline.

Generally, CRCTs begin to spawn when spring floods start to recede in late spring and early summer. This behavior may be triggered by changes in water temperature. Fecundity varies with individual size; a 290-mm female can lay over 600 eggs. Water temperature, elevation, and climate variations determine fry emergence, which usually occurs in late summer. Maturity is reached approximately 3 years after.

There is limited information on habitat requirements for CRCT. This species spawns over gravel substrates with good water flows. Studies have provided evidence of a positive association between CRCT presence and the amount of large woody debris, depth, and low water velocity. However, many streams that present CRCT do not present these habitat characteristics. CRCT generally feed on macroinvertebrates. Adults can also feed on other fish and eat larger proportions of large macroinvertebrates and terrestrial insects than subadults.

Introduced species may outcompete CRCT, as this species did not evolve with other salmonids. The different life history treats of non-native salmonids also poses a competitive advantage of these species over the native trout. Brook trout reach larger sizes than CRCT by their first winter season as they spawn in the fall and fry emerge early in the spring. Furthermore, brook trout mature earlier and have the potential to produce a greater number of offspring during their life span.

TEPS Birds

3.1.2.6 Bald Eagle

In Utah, the bald eagle is primarily a winter resident, with only four known pairs of nesting eagles in the state, none of which occur on the MLNF. An eagle nest does occur on private land about 18 miles east of the northeastern boundary of the analysis area, near the town of Castledale. It is unlikely that individuals from this eagle pair would utilize portions of the analysis area for foraging, since suitable habitat is available closer to the nest site. Several hundred bald eagles winter in Utah, where they typically congregate in large groups at roost sites. Wintering eagles typically begin arriving in November, are most abundant in January and February, and begin migrating north in March. Bald eagles generally utilize

cottonwoods and snags near open bodies of water as winter roosting sites, and feed opportunistically on live or dead fish, waterfowl, and mammals (Beck 1980).

Only one observation of bald eagles was recorded in the analysis area during the analysis period. Five bald eagle individuals (3 adults and 2 juveniles) were sighted in November 2003 along Cowboy Creek, presumably during fall migration. Winter roosting habitat is limited in the analysis area due to the high elevation and lack of roost trees. Potential roosting habitat occurs along the lower portion of Muddy Creek, in the tract buffer. Foraging habitat is present along Muddy Creek and its main tributaries, as well as in Julius Flats Reservoir. It is likely that these waterbodies are used in late fall and early winter, before they freeze over. In general, use of the permit area would be incidental and likely in connection with fall or spring migration.

3.1.2.7 Mexican Spotted Owl

Spotted owls in Utah are generally found in the pinyon-juniper zone, below the mixed conifer forests typical of owl habitat in Arizona and New Mexico. These birds select steep, narrow, cool canyons for roosting and nesting. These sites are characterized by small clumps of true fir and deciduous trees growing within cool canyons or on steep north-facing slopes. Ponderosa pine/gamble oak forests are also used if they exhibit characteristics of large cavity trees, broken tops, numerous snags, and heavy accumulations of down woody material. During the winter, the owls tend to move out of the canyons and onto mesa-tops, benches and warmer slopes (Wiley 1992). Spotted owls apparently use a wider array of habitat types for foraging than for nesting and roosting, including fairly open and non-contiguous forest, small openings, and pure ponderosa pine stands. Little is known about the habitat requirements for dispersal. Mexican spotted owls are generally absent from high elevations. (Rodriguez 1998.)

Potentially suitable canyon habitat for spotted owls occurs in the analysis area. However, the analysis area is north of the known distribution of this species in Utah and is above the elevation generally used by this species. Suitable habitat was surveyed in 2002 and 2003 by Arizona Biological Surveys. No spotted owl responses were detected in the survey area. The likelihood of occurrence of this species in the analysis area is very low due to elevation and geographic range.

3.1.2.8 Northern Goshawk

The northern goshawk is a forest habitat generalist that uses a wide variety of forest ages, structural conditions, and successional stages. The goshawk preys on large-to-medium-sized birds and mammals which it captures on the ground, in trees, or in the air. Selected goshawk prey includes squirrels, chipmunks, woodpeckers, jays, rabbits, and grouse. Specific habitat attributes include snags, downed logs, woody debris, large trees, herbaceous and shrubby understories, and a mixture of various forest vegetative structural stages. (Reynolds et al. 1992.)

Three components of a goshawk's home range (total about 6,000 acres) have been identified: nest area, post fledging/family area (PFA), and foraging area. The nest area is approximately 30 acres and may include one or more nests. It is usually located on northerly aspects in drainages or canyons, and is often near streams. Nest areas contain one or more stands of large, old trees with a dense canopy cover. The PFA surrounds the nest area. It totals approximately 420 acres and most often, because of its size, includes a variety of forest types and conditions. Small openings, snags, downed logs, and woody debris are critical PFA attributes. Goshawk foraging areas are approximately 5,400 acres in size. Observations of foraging goshawks show that they hunt in many forest types and conditions. This opportunism suggests that the choice of foraging habitat may be as closely tied to prey availability as to habitat structure and composition. (Reynolds et al.1992.)

Suitable habitat is present in the analysis area, but is limited primarily to the aspen and aspen mixed conifer cover types on the western portion of the tract buffer. Two years of surveys were conducted for goshawks in suitable habitat in the analysis area (see section 2.4.1.3). Goshawks were heard and/or seen at four calling stations. No nests or juveniles were found, but it is assumed that there was at least one active nest in the area, and likely two, based on the distance between responses and size of home ranges.

The Forest Service has been monitoring two goshawk nests near or in the analysis area. One occurs north of Julius Flats Reservoir, on the edge of the northern buffer boundary. The analysis area contains a portion of the nest stand, and is within the PFA and foraging area for this pair. The other nest occurs near Meadow Gulch, about one mile north of the northeast side of the buffer boundary. The analysis area is within the foraging area for this pair. None of the goshawk responses during the survey effort occurred within the home ranges of the known goshawk pairs, indicating that these goshawks were from a different pair or pairs.

The northern goshawk was added to the list of MIS for the MLNF in June 2003 as an amendment to the 1986 Forest Plan. This species replaced the blue grouse as a MIS. One of the standards and guidelines associated with goshawk management is monitoring of territory occupancy on a Forest-wide basis. Less than 20 percent decline in territory occupancy over a 3-year period is considered acceptable for this species. Monitoring efforts conducted since 1992 for the northern division of the MLNF indicate that territory occupancy has been at least 30 percent and thus within an acceptable range for this species (Jewkes 2004a). However, breeding bird trend studies for the state of Utah indicate that this species has been decreasing throughout its range since 1966 (Sauer et al. 2003).

3.1.2.9 Flammulated Owl

Flammulated owls occur in mixed pine forests, from pine mixed with oak and pinyon at lower elevations to pine mixed with spruce and fir at higher elevations. They have also been found in aspen, second-growth ponderosa pine, and mixed coniferous forest. Preferred habitat is mature ponderosa pine/Douglas-fir forests with open canopies. Large diameter (>20 inch dbh) dead trees with cavities at least as large as northern flicker cavities are important site characteristics. Flammulated owls are strictly nocturnal and feed almost exclusively on insects. Foraging occurs in large, open forest stands with space between the tree crowns to provide room for flight and hovering (Reynolds and Linkhart 1987). Territory size varies from 20 to 59 acres and is determined by age and patchiness of tree canopy. Flammulated owls are migratory in the northern part of their range. They arrive on their breeding territories in May and depart by mid-October, when they migrate south to central Mexico and Central America.

Preferred habitat is present in the southeastern portion of the analysis area. In addition, aspen stands to the west provide suitable habitat for this species. Two years of surveys were conducted for flammulated owls in suitable habitat in the analysis area (see section 2.4.1.4). Flammulated owls were heard and/or seen at 26 calling stations. No nests or juveniles were found, but based on the number of responses and small territory size, it is assumed that several pairs of flammulated owls occur in the analysis area.

3.1.2.10 Peregrine Falcon

Peregrine falcons are found in a wide variety of habitats in the Intermountain West. They prefer to nest on cliffs (generally at least 200 feet in height), usually in mountainous areas or in river canyons and gorges, although aeries are also known in metropolitan areas on structures such as towers and high-rise buildings (Bond et al. 1984). Peregrines prey almost exclusively on other species of birds, especially doves, pigeons, shorebirds, waterfowl, and passerines. They may forage up to 18 miles away from their aeries, although most hunting occurs within a 10-mile radius of the nest, and often over 80 percent of the foraging occurs within 1 mile of the aerie (Ehrlich et al. 1988). Peregrines overwinter in a wide range of habitats, but in the Intermountain West they appear to concentrate along large rivers and in wildlife

refuges. Some birds may remain on their breeding territories throughout the year if there is an adequate food supply (Spahr et al. 1991). Aeries have been reported at elevations above 10,500 feet, although nesting above 8,000 feet is extremely rare (Bond et al. 1984).

Suitable nesting habitat is present in the analysis area, on the rock escarpments bordering parts of Muddy Creek and its tributaries. A pair of peregrine falcons was observed in 2002 near the rim of Muddy Creek Canyon in the eastern portion of the tract buffer. The pair was exhibiting territorial behavior thus it is presumed that a nest was nearby within the cliff faces. A peregrine falcon was observed circling above an inactive golden eagle nest during UDWR aerial surveys in 2003, less than one-half mile from the 2002 observation. No falcons were observed in 2001.

3.1.2.11 Three-Toed Woodpecker

Three-toed woodpeckers typically inhabit spruce/fir forests up to 9,000 feet, but where insect populations are high they may also occur in ponderosa or lodgepole pine forests. They are most apparent in years and locations where trees have high insect populations, and are attracted to areas with numerous dead trees from wildfires, insect epidemics, blow-down, or other die-off (Andrews and Righter 1992). The woodpeckers forage on wood-boring insects in dead trees, primarily spruce beetles (Peterson 1990). Soft snags are preferred for excavating nest cavities, although they occasionally excavate live trees. This species may make small movements off its breeding territory in the winter to find food but is generally a year-round resident.

There has been an ongoing outbreak of spruce beetle in the MLNF and subsequently, localized areas of spruce forest in the analysis area have been infected and contain suitable habitat for three-toed woodpeckers. Surveys for this woodpecker in the analysis area resulted in 16 individual responses at 13 separate locations (see section 2.4.1.5). Additionally, a female was observed incidentally in the area during a goshawk survey. All woodpecker observations were in the western portion of the tract buffer and associated with the aspen and aspen mixed conifer habitat type. It was assumed that three or more nesting pairs were present during the survey period.

3.1.2.12 Greater Sage-Grouse

The greater sage-grouse is an upland game bird that is entirely dependent upon sagebrush communities for all stages of its life cycle, with extensive areas of this habitat type required year-round. Sage-grouse have a high fidelity to their seasonal habitats (breeding, late brood-rearing, and wintering habitats), and females commonly return to the same areas to nest each year. Depending on geographic location, breeding activities occur from March through early summer. Most sage-grouse nests are located under sagebrush plants that provide overhead cover, with 15 to 30 percent canopy cover preferred. Late brood-rearing habitats, used from summer into fall, usually have less dense sagebrush canopy than nesting habitats and generally have a higher proportion of grasses and forbs in the understory. Riparian meadows, springs, and streams are also used during this time, especially in dry years, as these areas produce the forbs and insects necessary for juvenile birds. Because the diet of chicks consists of forbs and insects, diverse plant communities with abundant insect populations are especially important. During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds, so exposure above the snow, rather than canopy cover, is critical. (BLM 2003.)

Sage-grouse were historically abundant in the analysis area, and one known lek site, the Wildcat Knoll strutting ground, is currently used. Fourty-eight sage-grouse were transplanted to the southern portion of the analysis area by UDWR between 1987 and 1990. UDWR has been annually monitoring the Wildcat Knolls strutting ground since 1991, and grouse from the reintroduction effort use this site. The site has received use by 3 to 20 cocks on a given year, with the lowest numbers observed in 2003. Grouse sign was observed in additional portions of the analysis area that potentially provide suitable habitat for lek

sites. These sites were surveyed during the breeding season, and although a few cocks and hens were observed between the Head of Box Canyon and East Fork Box Canyon, the birds were not engaged in any lekking displays. Abundant grouse sign was observed in that area and several adults were observed near the headwaters of Box Canyon later in the year. It is assumed the canyon edges are used for roosting. Brood-rearing habitat is also present. In addition, several grouse were observed drinking from cattle troughs in this area. Grouse were also observed using Box Pond as a watering site.

Winter and brood-rearing habitat was mapped by the UDWR and overlaps approximately 39 percent of the analysis area. These areas coincide with locations where grouse and grouse sign were observed.

TEPS Mammals

3.1.2.13 Canada Lynx

Mature to late-successional spruce-fir forests provide suitable foraging habitat for Canada lynx in the southern portion of its range. These forests can support snowshoe hares, the primary prey species for lynx, as well as red squirrels, an important alternative prey species. Early successional stands with high densities of shrubs and seedlings are optimal for snowshoe hares, and subsequently important for lynx. Conifer-aspen forests, particularly those with dense regeneration or an extensive shrub and woody debris understory component, may also be important for prey species. The Canada lynx breeds from late winter to early spring, with denning beginning in late spring. Mature forest stands are used for denning, cover for kittens, and travel corridors. Denning habitat includes dense downed trees and root wads, or dense live vegetation (Koehler 1990, Mowat et al. 2000). For denning habitat to be functional, it must be in or adjacent to large areas of quality foraging habitat (Ruediger et al. 2000).

Reports of lynx in Utah indicate no sightings between 1961 and 1993 on the MLNF (Ruggiero et al. 1994). Recent records of lynx in Utah include a 2002 record from the Manti-La Sal National Forest (Forest Service 2002b). This record was from a hair sample collected in an isolated location near Joe's Valley. No additional lynx have been recorded in this area and it is likely that this individual was dispersing through the forest as opposed to having an established home range. Lynx are considered extremely rare in Utah and, of the few historic sightings that have occurred, the majority have been in the Uinta Mountains. Suitable habitat for lynx is limited due to the isolated nature and small size of forest patches on this part of the Forest, but could potentially occur in the western portion of the analysis area.

3.1.2.14 Spotted Bat

Spotted bats are found in relatively remote, undisturbed areas in a variety of habitats, including open ponderosa pine, desert shrub, pinyon-juniper, and open pasture and hay fields, and have been recorded at elevations as high as 9,500 feet. They roost alone in rock crevices on steep cliff faces and have been found hibernating in caves. Spotted bats are territorial and use echolocation to avoid each other while foraging. Their diet consists primarily of moths caught in flight after dark in open pine stands and over marshes (Wai-Ping and Fenton 1989). Information on seasonal movements is scarce, though spotted bats are thought to migrate south to hibernate.

Suitable roosting habitat for spotted bats is abundant in vertical cracks of the sandstone cliff faces of steep canyons in the analysis area. Riparian habitat and forest edges in this area also provide potential foraging opportunities. Several spotted bats were identified in the analysis area by audible vocalizations.

Auditory bat observations were associated with the rocky cliff habitat and ponderosa pine along the East Fork and main stem of Box Canyon and along Greens and Cowboy Canyons. Bats were also observed foraging in the limber pine habitat near Julius Flats Reservoir and above the North Fork of Muddy Creek, and in the limber pine/Douglas fir habitat along the jeep trail running west and south of Cowboy Creek.

Spotted bats have also been identified in Muddy Creek Canyon and the lower end of Box Canyon with ANABAT detectors (Perkins and Peterson 1997).

3.1.2.15 Western Big-Eared Bat

Townsend's big-eared bats use juniper/pine forests, shrub/steppe grasslands, deciduous forests, and mixed coniferous forests from sea level to 10,000 feet. During winter they roost singly or in small clusters in caves, mine shafts, rocky outcrops, or occasionally in old buildings (Oliver 2000). They remain at these sites, called hibernacula, from October to February. They do not migrate, but will move to different roost locations within hibernacula during winter. In summer, females roost with their young in nursery roosts. Males and non-breeding females roost alone. Big-eared bats are sensitive to human disturbance and will abandon roost sites if disturbed. Townsend's big-eared bats are nocturnal insectivores and prey primarily on moths along forest edges.

No substantial caves have been observed in the analysis area and no other structures are considered potentially suitable for western big-eared bat hiberbacula.

TEPS Amphibians

3.1.2.16 Spotted Frog

Columbia spotted frogs are found in areas where permanent, quiet water is present, such as marshy edges of ponds or lakes, algae-grown overflow pools of streams, emergent wetlands, and near springs. Emergent and submergent vegetation are considered important habitat features. Following the spring breeding season they may move considerable distances from water, often frequenting mixed conifer and subalpine forests, grasslands, and brushlands of sage and rabbitbrush if puddles, seeps or other water is available. However, in the Wasatch front, research indicates that spotted frogs travel only short distances between breeding and post-breeding habitats, with dispersal corridors typically being limited to aquatic or semi-aquatic habitats such as streams, intermittent drainages, and seeps, and that many breeding sites serve as year-round habitat (FWS 2002). Adult spotted frogs feed on invertebrates, generally within 0.5 meters of shore on dry days. During and immediately after rains, they may move away from permanent water to feed in wet vegetation or ephemeral puddles (Licht 1986). Spotted frogs hibernate during winter and emerge to breed when open water becomes available, generally during spring thaw.

Utah is in the southern portion of the spotted frog range in which two populations, the Wasatch Front and West Desert populations, are known to exist. These are believed to be relict populations, occurring in small patches of suitable habitat remaining since the last ice age (FWS 2002). Spotted frogs have not been located on the MLNF, although individuals were observed near Fairview, just west of the Forest. These frogs were likely from the southernmost range of the Wasatch Front population. Spotted frogs were not observed during survey efforts in the analysis area. Although potentially suitable habitat is present in localized areas, the analysis area is outside of the known and predicted range of this species, and it is unlikely that spotted frogs are present.

3.1.3 Management Indicator Species

Golden eagles, mule deer, elk, and aquatic macroinvertebrates are discussed in the following section. Although goshawks are also a MIS, they are addressed above as a Forest Service sensitive species in section 3.1.2. Since blue grouse are no longer a MIS for the MLNF, they are discussed briefly in section 3.1.4.

3.1.3.1 Golden Eagle

Golden eagles are typically found in open country, including shrublands, grasslands, canyons, and desert plains, as well as open coniferous forests in mountainous regions. Elevated nest sites, typically on cliff faces near hunting grounds, are the preferred breeding habitat. In the absence of suitable cliffs and rock outcrops, they have been known to nest in trees. Golden eagles feed mainly on small mammals, especially rabbits, marmots, and ground squirrels, but also eat insects, snakes, birds, juvenile ungulates, and carrion. Golden eagles typically mate for life. The breeding season generally begins in mid-January and continues through mid-September, though it can vary according to geographic region.

Suitable nesting habitat is present in the northern and northeastern portions of the analysis area on rock escarpments along Muddy Creek Canyon and some of its tributaries. Aerial surveys for eagles have been conducted by UDWR since 1998. Twelve golden eagle nest sites are known in the analysis area, of which one has been active and seven more tended at least once over the last six years.

3.1.3.2 Mule Deer

Mule deer are found in coniferous forests, shrub steppe, chaparral and grasslands with shrubs, from dry, open country to dense forests. They are often associated with early successional vegetation. They are known to utilize rocky brushy areas, open meadows, open pine forests, and burns. Mid to late seral range vegetation is used for forage. They browse on various grasses and forbs during the spring, summer, and fall, and on woody plants during the winter. Thermal and hiding cover is required year-round by elk. Thermal cover for deer generally consists of small conifers and shrubs on winter range, and deciduous or evergreen saplings or shrubs with high canopy closure on summer and spring-fall ranges. Water is also an important habitat component, especially on summer range. Fawning habitat for deer consists of low shrubs or small trees (2 to 6 feet tall) under a partially closed forest canopy. The fawning areas tend to be relatively small, close to water (less than 600 feet), and on mild slopes where succulent vegetation is abundant (Thomas et al. 1979).

The Muddy analysis area contains winter and summer range for mule deer. The value of this range is classified as high summer (~14,855 acres) and high winter (~18,860 acres). The range combined covers over 90 percent of the analysis area.

Annual winter counts of deer are not conducted by the UDWR. However, population data is modeled using harvest data for the entire Manti Deer Management Unit, which contains the analysis area. For the 2000 to 2001 hunting season, the post-hunting and spring populations in the Unit were predicted to be 3,603 and 5,436 individuals, respectively. The fawns/100 does were estimated at 69, fawns/100 adults at 60, and bucks/100 does at 14 for the post-hunting season. The deer population is far below the UDWR objectives for this unit and has been so for several years. The decline in deer populations is attributed to the drought and other natural environmental factors (UDWR 2001b).

3.1.3.3 Elk

Elk inhabit coniferous and mixed-coniferous forests as well as woodlands, chaparral, and grasslands in the Rocky Mountains. Mid to late seral range vegetation is used for forage. They rely on grasses for most of the year but also consume forbs in the summer and may browse on woody plants where grasses are unavailable, especially during winter months. Water is an important habitat component, particularly on summer range. During the summer elk spend the majority of their time in alpine and subalpine mountain meadows or in stream habitats. Thermal and security cover is required year-round by elk and generally consists of mature forest with large amounts of edge along grasslands or meadows. During the winter, elk movements are restricted by forage availability and snow conditions, and heat and energy are conserved in order to survive. Elk migrate altitudinally to lower elevations where snow depth is shallow and typically inhabit coniferous forests interspersed with riparian areas and south-facing slopes with

sagebrush and shrubs, as well as aspen forests. Calving habitat for elk contains forage areas, hiding cover, and thermal cover within forest stands. Components of this habitat include shrubs or downed logs, gentle slopes, succulent forage, and a source of nearby water (less than 1,000 feet).

The Muddy analysis area contains winter and summer range for elk. The value of this range is classified as critical summer (~16,505 acres) and critical winter (~17215 acres). The range combined covers over 90 percent of the analysis area.

The winter aerial census for elk conducted in 2001 shows that the elk populations in the South Manti Sub-Unit of the Manti Management Unit to be slightly below UDWR objectives. However, elk numbers were purposely decreased, through increasing the number of cow tags issued, to compensate for the affects of the drought. A total number of 1,120 elk were counted on the South Muddy survey area and 449 in the North Muddy/Ferron survey area during this survey effort. Of these, 51 and 63 were bulls, respectively, and the remaining elk were antlerless. The calves/100 cows ratio was estimated at 29. A more recent winter census was conducted in January 2004 by UDWR, but summarized data is currently not available (UDWR 2001a).

3.1.3.4 Aquatic Macroinvertebrates

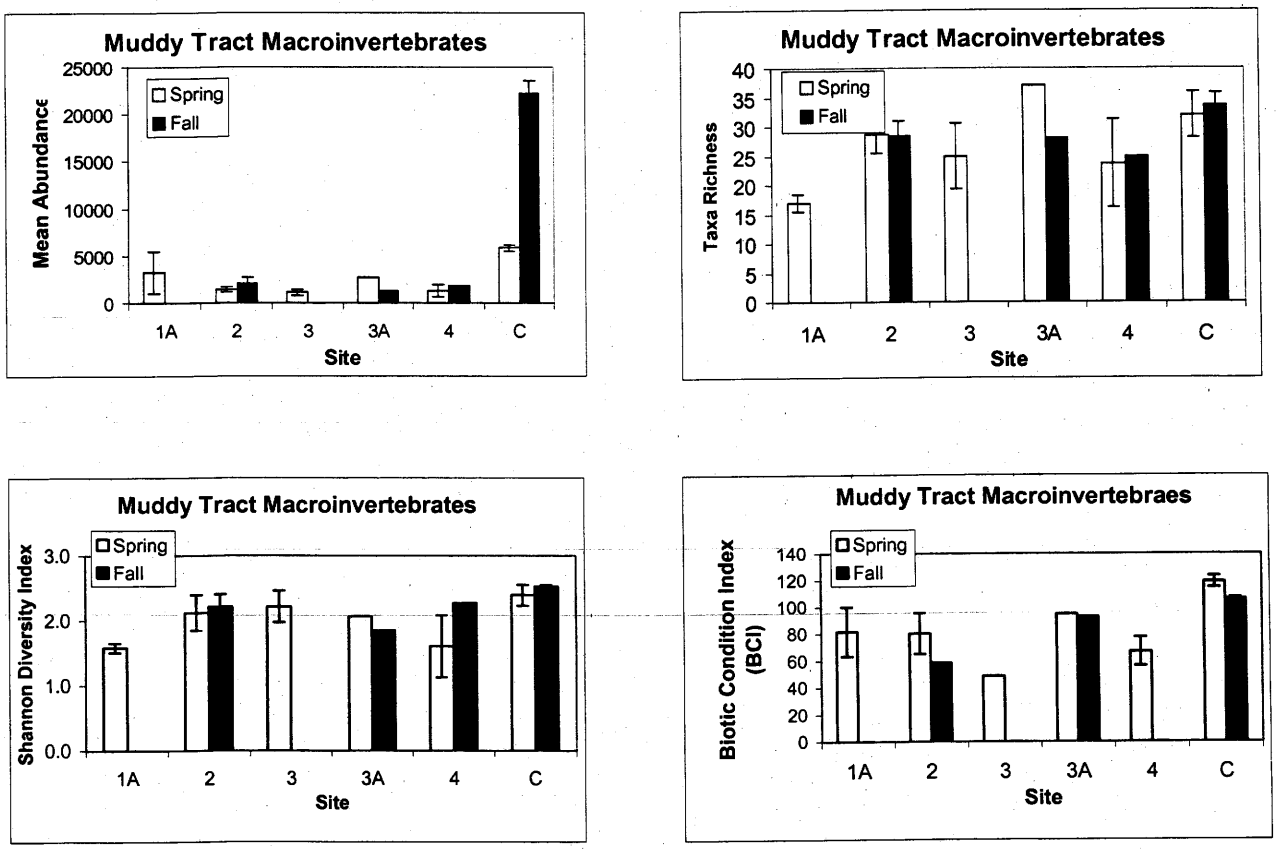
Macroinvertebrates are ecological indicators of the condition of aquatic habitats and the ability of these habitats to support fisheries. These species are affected by several environmental factors including water temperature, water quality, flow, and substrate type. Changes in aquatic habitats caused by management activities can lead to changes in the species composition and abundance of macroinvertebrates.

In general, higher abundance and diversity of macroinvertebrates are associated with cool water temperatures, substantial perennial flows, and diverse streambed substrate. Lower abundance and diversity are associated with ephemeral streams. In general, ephemeral streams present high water temperature, low flow, and streambeds with large amounts of fine sediment. Therefore, macroinvertebrate diversity and abundance within the analysis area is expected to be higher on perennial streams than in the ephemeral springs and drainages.

Aquatic invertebrate sampling was conducted in Greens Canyon (Sites 1 and 1A), Cowboy Creek (Sites 2, 3, and 3A), Greens Hollow (Site 4), and an unnamed stream near White Mountain Cabin (Control site). A total of 126 invertebrate taxa were identified in the 49 samples collected over the 3-year sampling period (2001 to 2003). Taxa from five functional feeding groups (shredders, scrapers, collector filterers, collector gatherers, and predators) were collected, with collector gatherers representing the highest number of taxa and individuals collected for each year of sampling. The five dominant taxa collected consisted of Turbellaria, Orthocladiinae, Baetis, Pericoma, and Chironominae, and the dominant families included Chironomidae, Baetidae, Psychodidae, and Nemouridae.

Mean macroinvertebrate abundance, richness, diversity, and biotic condition are depicted in Figures 1 through 4. The observed macroinvertebrate abundance was similar during spring and fall across the main sampling sites. Considerably higher invertebrate abundance was observed at the White Mountain Cabin control site. The lowest Taxa Richness and Shannon Diversity Index (H) estimates were observed at the Greens Canyon site. Higher H values were estimated at the remaining sites. These estimates, including the control, were similar across sites and seasons. Estimates of the Biotic Condition Index (BCI) were near or above the level required by the Forest management plan (BCI≥75) with the exception of the site located at Upper Cowboy Creek (Site 3; average BCI= 49). In general, these estimates indicated that the streams surveyed were in fair to good condition. In addition, the Hilsenoff Biotic Index (HBI) indicated that the surveyed streams are slightly (HBI: 2-4) to moderately enriched (HBI: 4-7). The highest HBI

estimates were observed at Upper Cowboy Creek (HBI=5.3) and Greens Hollow (HBI=5.7). A summary of results of the macroinvertebrate survey results in presented in Table 8 in section 2.4.2.5.



Figures 1-4. Summary of quantitaive macroinvertebrate surveys conducted in the Muddy analysis area. Mean abundance (#/m^2; Top-left), taxa richness (Top-right), Shannon diversity (Bottom-left), and biotic condition index (Bottom-right) for Greens Canyon (Site 1A), Lower Cowboy Creek (Site 2), Upper Cowboy Creek (Site 3), Middle Cowboy Creek (Site 3A), Greens Hollow (Site 4), and White Mountain Cabin (Control Site). Error bars represent one Standard Deviation.

3.1.4 Species of High Federal Interest

Species of high federal interest, as defined by the FWS, include several migratory birds. No other categories of wildlife were identified by the FWS.

3.1.4.1 Migratory Birds

Twenty-two migratory birds are on the list of species of high federal interest (see Table 9, section 2.4.3.1), of which seven are known to occur and ten could potentially occur in the analysis area. Species observed include the bald eagle, golden eagle, peregrine falcon, prairie falcon, Cooper's hawk, flammulated owl, and Williamson's sapsucker. Species that could potentially occur include the osprey, ferruginous hawk, merlin, western bluebird, Scott's oriole, burrowing owl, Mexican spotted owl, band-tailed pigeon, great blue heron, and black swift. The bald eagle, spotted owl, flammulated owl, peregrine

falcon, and golden eagle are discussed in sections 3.1.2.6, 3.1.2.7, 3.1.2.9, 3.1.2.10, and 3.1.3.1, respectively.

Of the species observed or potentially occurring in the analysis area, golden eagles, peregrine falcons, prairie falcons, and Mexican spotted owls use cliffs for nesting. Black swifts also may use cliff habitats, such as a ledge or a crevice, but nests are usually near or behind waterfalls. Flammulated owls use abandoned woodpecker holes in snags, and merlins typically use abandoned hawk nests in trees, but may also use cliffs. Cooper's hawks, ferruginous hawks, band-tailed pigeons, Williamson's sapsuckers, and western bluebirds typically nest in trees. Burrowing owls nest in mammal burrows in grasslands and Scott's orioles use suspended nests attached to shrubs or small trees. Bald eagles are not known or expected to nest in the analysis area, although perennial streams may be used for foraging.

3.1.5 Other Species

3.1.5.1 Fishes

Rainbow and brook trout were also observed during fish surveys conducted by UDWR on perennial streams in the analysis area. Rainbow trout were observed in Muddy Creek and South Fork of Muddy Creek, while Brook trout were only observed in Muddy Creek. The streams where cutthroat trout were also observed during surveys and incidentally (i.e., Muddy Creek and its South and North forks) present moderate to high quality trout habitat. As described in section 2.4.1.2, no fish were observed in the North Fork of Quitchupah Creek. Erosion, siltation, and low water flows have led to the poor trout habitat in this stream. Speckled dace (*Rhinichthys oscōlus*) have been observed on mainstem sections of Quitchupah Creek located outside of the analysis area.

3.1.5.1.1 Brook trout

Brook trout (*Salvelinus fontinalis*) is a sport fish native to the eastern United States and eastern Canada. This species has become established in many of Utah's cold higher-elevation lakes and streams. The diet of brook trout is based primarily on invertebrates, including insects and zooplankton; large individuals occasionally feed on small fishes. Spawning occurs in the fall over gravel substrate in lakes and streams. Hatching and emergence occurs approximately after two months. The successful reproduction of brook trout has lead to overcrowding, and consequently, to a large number of stunted (small) individuals in streams in Utah. The overcrowding problem can be exacerbated by low fishing pressure in the brook trout's high elevation habitat. This species poses a threat to native cutthroat trout populations (Sigler and Sigler 1996).

3.1.5.1.2 Rainbow trout

Rainbow trout (*Oncorhynchus mykiss*) is a popular sport fish in Utah. This species is native to western North America but is not native to Utah. The popularity if this species in addition to their unsuccessful reproduction in the wild has lead to the introduction of millions of rainbow trout to cold and cool waters throughout the state by the UDWR. The UDWR has also stocked an albino form of the rainbow trout into many Utah waters. Their diet is based primarily on invertebrates, including insects, worms, zooplankton, and insect larvae. Rainbow trout that reach larger sized can switch to a piscivorous diet. The species spawns in streams over gravel substrate during the spring, and the eggs hatch in about one month. Fry emerge occurs approximately two to three weeks after hatching. The presence of rainbow trout in streams that provide habitat to cutthroat poses a major threat to the native species. Similarities in the habitat and timing of spawning often lead to the production of rainbow - cutthroat hybrids, and thus, to the loss of genetic purity through hybridization (Sigler and Sigler 1996).

3.1.5.2 Blue Grouse

Blue grouse breed in open coniferous and aspen forests with a shrub understory or adjacent to shrublands. They spend the winter at higher elevations than summer habitat, primarily in Douglas-fir and lodgepole pine forests of various age classes and tree densities (Andrews and Righter 1992). They have also been known to winter in spruce forests in southwest Colorado. Grouse roost in large conifers with dense foliage. Grouse feed primarily on needles and buds of conifers in the winter (Douglas-fir often important) and berries, insects, flowers, and leaves in the summer.

Suitable habitat for blue grouse is present, but limited, in the analysis area. Grouse were observed at three separate locations in this area, and all observations were associated with or near small aspens and mountain shrubs. Potential brood-rearing habitat could occur within the forested portions of the analysis area. However, this habitat is not typical of that used by grouse, and the scant shrub component in the spruce-fir stands likely renders this habitat unsuitable. The forested portions of the project area are likely more suitable as summer habitat and potentially winter habitat.

3.1.5.3 Amphibians

Amphibian habitat is limited in the analysis area, consisting of wetlands, ponds (natural and stock), edges of lakes and reservoirs, springs and seeps, and pooled habitat adjacent to streams. Potentially suitable amphibian habitat surveyed during the analysis period resulted in observations of boreal toads, chorus frogs, tiger salamanders, and possibly Great Basin spadefoot toads. Chorus frogs were the most abundant species observed (see section 2.4.4.2). All life stages of chorus frogs and tiger salamanders (eggs, tadpoles, and adults) were observed in ponds. Chorus frogs were also heard at Julius Flat Reservoir. All boreal toad observations were of larvae in ponds. Great Basin spadefoot toads were potentially heard at a cattle pond and in a stream channel at the bottom of Box Canyon.

Other amphibian species that could potentially occur in the analysis area include the great plains toad, woodhouse's toad, and northern leopard frog. Spotted frogs are not expected to occur as far south as the analysis area.

3.1.5.4 Reptiles

Suitable habitat for several reptile species is present in the analysis area. Lizard, whiptail, and skink species primarily occur in desert and semi-desert areas with sandy or rocky soil and sparse vegetation, such as pinyon-juniper and sagebrush, but also occur in grasslands and the lower edge of the spruce-fir zone. Habitat for snake species is also variable, ranging from lowlands to high mountains, with some species having an affinity for riparian habitats, and others for more arid environments.

Five reptile species were incidentally observed in the analysis area: the eastern fence lizard, tree lizard, sagebrush lizard, short-horned lizard, and western terrestrial garter snake. Reptile species not observed but likely present include the common side-blotched lizard, gopher snake, night snake, striped whipsnake, and western rattlesnake. Other species possibly present include the Great Basin collared lizard, long-nosed leopard lizard, desert spiny lizard, Western whiptail, Western skink, Eastern racer, milk snake, Southwestern blackheaded snake, and ground snake.

3.1.5.5 Small Mammals

Seventy species of small mammals could potentially occur in the study area, including 5 shrews, 15 bats, 8 small carnivores, 36 rodents, and 6 lagomorphs. Of these, 16 were observed by Cirrus personnel (1 bat, 1 carnivore, 10 rodents, and 4 lagomorphs). All habitats in the analysis area are potentially used by at least some small mammals, with riparian habitats being used by the largest number of species.

3.1.5.6 Non-Game Birds

A total of 203 species of non-game birds could potentially occur in the study area. Of these, 84 were observed by Cirrus personnel. All habitats in the analysis area are potentially used by at least some non-game birds, with riparian habitats being used by the largest number of species. Non-game species that potentially use cliffs in the analysis area for nesting include, but are not limited to, the golden eagle, prairie falcon, peregrine falcon, red-tailed hawk, Mexican spotted owl, raven, white-throated and black swifts, cliff swallows, canyon wren.

3.2 Detailed Technical Assessment/Description of the Potential Effects

This section presents an assessment and description of potential impacts to aquatic and terrestrial wildlife resources. The section is organized by issue statement, with Alternatives 1 through 3 addressed under each issue. The evaluation criteria defined in the RFP for this project was used as a guide for determining potential impacts. The available data was used to predict reasonable foreseeable mining scenarios and is used in the analysis of the four wildlife issues.

3.2.1 Wildlife Issue 1

Any changes in water flow and quality in perennial drainages and reservoirs or to riparian vegetation/wetlands could affect habitat for terrestrial and aquatic species.

3.2.1.1 Alternative 1: No-Action

No leasing or mining would occur under this alternative. No changes in water flow or quality of perennial streams and drainages or to riparian and wetland ecosystems would be expected. Therefore, habitat for terrestrial and aquatic species would not be affected.

3.2.1.2 Alternative 2: Standard Lease Terms and Conditions Only

Under this alternative, the tract would be leased and mined with BLM standard lease terms and conditions. This alternative would allow longwall mining (full extraction) throughout the tract, which could result in subsidence of perennial drainages, escarpments, and surface facilities. The duration of mining for complete coal recovery would be approximately 20 years. Localized impacts associated with mining, such as subsidence and subsidence-induced tension cracks as discussed below, are estimated to occur over one to two years, with the majority of the subsidence occurring in the first three weeks after coal extraction.

Mining activities would result in subsidence-induced ground movements and other changes in geology and topography. These changes include variations in stream gradient, tension cracks, and rock failures. Subsurface disturbances could cause temporary cracks to open up in streambeds, which could divert flow underground. Temporary disruptions of ground and surface water flows could reduce water availability for fish and aquatic invertebrates. In addition, subsidence could disturb escarpments in localized areas (MTI 2004), which could lead to major disruptions of the natural sediment delivery process to streams (Nelson et al. 2003). These changes could influence the abundance and community structure of aquatic species.

As stated in the Surface and Ground Water Technical Report prepared for the Muddy Creek Tract, cracks resulting from subsidence could enhance the rate of vertical flow from ground waters, and thus lead to reduced flow at springs originating above the mined area. The likelihood of springs drying up completely is low, and due to differences in the overburden thickness, the risk of permanent impacts from vertical

fractures is expected to be low, with the exception of the Box Canyon springs. If flow is permanently affected at these springs, the water diverted underground would be expected to discharge at a different location further down slope.

Perennial streams that would be undermined under Alternative 2 and may be affected by subsidence include Muddy Creek and tributaries of Cowboy Creek. As discussed in the Surface and Ground Water Technical Report, subsidence of streams could intercept flowing water and divert it into underground workings or enhance subsurface flow in the shallow bedrock underlying the stream valley. Stream segments occurring within the Castlegate Sandstone outcrop along Greens Hollow and Cowboy Creek and the segments with low overburden cover along Muddy Creek, Horse Creek, and Greens Canyon present the highest risk of subsidence. The risk of water diversion into underground workings is greatest for Muddy Creek, and would likely result in a loss of stream flow and alluvial groundwater. Subsidence fracturing would also pose a significant risk of enhanced water losses from Greens Canyon, and would likely reduce the length of perennial flow of the stream segment. Subsidence could lead to the temporary reduction in intermittent flows of Greens Hollow and Cowboy Creek and an increase in subsurface flow in the fractured bedrock.

Mining could also impact ponds (natural basins and stock ponds) and wetlands. Although these habitats make up a small portion of the analysis area and impact zone, they are important for a large number of wildlife species. Subsidence-induced tension cracks could divert surface water to underwater networks on a temporary basis (less than 2 years), thus reducing the availability of water for aquatic and terrestrial wildlife. These cracks could potentially cause ponds to dry up. Over time, as the tension is released, the cracks would close, and organic debris would fill the remaining gaps. Stress on riparian vegetation, loss of wetlands, and/or changes in species composition could result from the temporary changes in water availability, thus indirectly impacting wildlife. No reservoirs are inside of the zone of potential impact. Therefore, no impacts would result to this form of aquatic habitat.

Mining could impact escarpments in areas located near Box, Greens, and Muddy canyon. Potential effects in these areas include the formation of cracks and spalling of escarpments (MTI 2004). In addition, localized areas could also be affected by water withdrawals for exploration drilling.

Impacts to water quality from subsidence, as discussed in the Surface and Ground Water Technical Report, are expected to be minor and imperceptible. Therefore, the remainder of this section focuses only on potential impacts to wildlife from changes in water flow or to riparian vegetation and wetlands. Potential impacts to specific species or groups are described below.

3.2.1.2.1 Fisheries

The cutthroat trout, thought to belong to the native Colorado River subspecies, is the only fish species of concern within the analysis area. This native species occurs in Muddy Creek and thus could be impacted by flow reductions caused by diversion of water to underground workings. The risk of flow diversions is greatest in the area of low overburden cover along Muddy Creek. The magnitude of potential impact to cutthroat trout depends on the volume of surface water that could be lost to subsurface flows. Fish migrating upstream to spawn require suitable water velocities and depths to succeed. Thompson (*in* Bjorn and Reiser 1991) quantified the minimum water depth that would allow trout migration. According to his estimates, migration would succeed in depths of 0.12 to 0.18 meters. Based on recent surveys, the average stream depth in Muddy Creek is 0.57 meters. A reduction in water depth of 68 to 78 percent in this stream could influence the spawning success of the native cutthroat trout species. In addition, flow regulates the amount of spawning area available by regulating the area covered by water and the water velocity over gravel beds (Bjorn and Reiser 1991). Hunter (*in* Bjorn and Reiser 1991) determined that cutthroat trout prefers water depths greater than 6 centimeters and velocities between 13 and 72 centimeters per second. Reductions in depth and velocity below these levels could also impact the

spawning success of cutthroat trout. Further, fish are not uniformly distributed at all depths in a stream. For example, Pratt (*in* Bjorn And Reiser 1991) determined that cutthroat trout less that 100 mm used lower depths than fish larger than 100 mm (32 and 62 cm respectively). Consequently, potential reductions in flow and water depth could lead to more negative impacts on small cutthroat trout than on larger fish. These effects are expected to be temporary, as seasonal flows are likely to transport substrates downstream and thus fill in cracks within a short time period. According to the Geology Technical Report prepared for the Muddy Creek Tract, the natural recovery of tension cracks in a streambed could range from a few weeks to one or two years. Mitigation is recommended in section 3.3 to minimize potential impacts to fisheries habitat.

Activities that deplete water from the Colorado River have been identified by the FWS as having adverse cumulative effects to the endangered bonytail, Colorado pikeminnow, humpback chub, and razorback sucker. However, transbasin water diversions that could affect these species are not expected. Changes to water flow in the analysis area would not result in water depletions from the Colorado River Basin. A reduction in flow along Muddy Creek is expected, but because of the existence of water rights along this stream, the coal-mining permit would require mitigation by either sealing the subsidence fractures or providing alternative water supplies. With implementation of these and other recommended mitigation measures, formal consultation with FWS for the four endangered fish species would not be warranted.

3.2.1.2.2 Macroinvertebrates

Aquatic macroinvertebrates depend on the flow of seasonal and perennial waters. Higher abundance and diversity of macroinvertebrates are usually associated with cool water temperatures, substantial perennial flows, and diverse streambed substrate. Lower abundance and diversity are associated with intermittent streams with high water temperature, low flow, and streambeds with large amounts of fine sediment. Potential flow reductions in localized areas in Muddy Creek could modify the species composition and abundance at a stream reach scale. As discussed in the Surface and Ground Water Technical Report prepared for the Muddy Creek Tract, the risk of subsidence fractures intercepting stream water and diverting it into underground mine workings is greatest in areas of low overburden cover along Muddy Creek.

Potential damage from tensile strains that could cause surface cracks and spall of escarpments is also expected in areas located near Greens, Box, and Muddy canyons (MTI 2004). However, as discussed in section 3.2.1.2.1, tension cracks in the streambed would recover naturally, in as little as a few weeks, or up to two years. The Biotic Condition Index (BCI >80) at Greens Canyon indicated that this stream is in good condition. Under this alternative, potential flow losses or reductions in this stream could affect invertebrate habitat, abundance, and diversity. A reduction of 20 percent or more in the BCI would require further evaluation and possibly a change in management direction as required by the Standards and Guidelines defined in the Forest Management Plan for the MLNF (Forest Service 1986).

Minimal impacts on aquatic invertebrates within the tributaries of Cowboy Creek are expected, as the effects from subsidence on stream flow are expected to be minimal (MTI 2004). However, temporary reductions to intermittent flows and perennial reach lengths could occur in Greens Hollow and Cowboy Creek as a result of surface tensile fractures in the nearby Castlegate Sandstone, and could cause associated reductions to invertebrate habitat, abundance, and diversity. Impacts to Greens Hollow and to the intermittent portions of Cowboy Creek could potentially pose a greater risk to associated invertebrate communities than to those in Greens Canyon, given the low Biotic Condition Index (BCI<65; poor quality) of these stream reaches and the presence of grazing in these areas. However, as discussed above, tension cracks would recover naturally, thus the impacts to stream flow and associated invertebrate communities would be temporary.

3.2.1.2.3 Birds

Potential stress on the riparian vegetation from diversion of surface water could reduce the function and value of riparian habitat to many bird species. However, since the majority of impacts to surface water would be short-term (less than 2 years), associated impacts on vegetation and wildlife are expected to be temporary. An exception could be to Muddy Creek, where impacts to water flow could be longer term, potentially leading to a loss of riparian habitat. Riparian habitats provide important brood-rearing habitat for sage-grouse, as the young rely on insects and succulent forbs. A reduction in riparian habitat or surface water availability could therefore impact brood-rearing habitat for sage-grouse. Riparian habitat represents a critical component of several non-game bird species, including many warblers. Stress on riparian vegetation could reduce the availability or quality of nesting and/or foraging habitat for these species. Several bird species also rely on pooled or flowing water as a water source. Changes in the availability of free water may result in modification in behavior of birds as they search for alternative water sources.

3.2.1.2.4 Mammals

Loss of surface water could impact deer and elk, but this impact would be limited to seasons when snow and succulent forage were not available. The impact would be minor, causing temporary modification in behavior and daily movements as they search for alternative water sources. The potential stress on riparian vegetation and temporary reductions of surface waters could impact the quality of habitat for several small mammals, particularly those that rely on riparian habitats for foraging, such as some shrew and bat species. However, these impacts would likely be temporary.

3.2.1.2.5 Amphibians

Changes in water flow could reduce the amount of habitat available to amphibians in the analysis area. Because amphibians are dependent on water for at least part of their life cycle, a decline in number of individuals would be expected if a substantial loss of flow resulted from mining-induced subsidence. These impacts would be temporary (less than 2 years), lasting until the tension cracks sealed and surface waters were restored.

The majority of amphibians observed in the analysis area were in ponds. The majority of these ponds, including those where boreal toads were observed, was near the perimeter of the buffer boundary, and would therefore not be impacted. However, a few ponds are within or near the area that would be undermined. If cracks occurred in these ponds, surface flow would be temporarily reduced or eliminated, thus eliminating potential amphibian breeding habitat for the duration of the affect. However, as discussed in the Surface and Ground Water Technical Report prepared for the Muddy Creek Tract, all of the ponds within the study area are located at least 1,000 feet above the mine coal. Therefore, the risk of tensile cracks from mine subsidence causing enhanced water loss from ponds would be relatively low. Furthermore, since the ponds are located within formations that contain abundant shales and clays, any surface tensile cracks that may occur as a result of mine subsidence would likely seal.

Wetlands provide an abundant source of insects for amphibians to feed on. Therefore, potential impacts to springs and associated wetlands from mining-induced subsidence, as discussed in the Vegetation Technical Report prepared for the Muddy Creek Tract, would affect amphibian habitat. With the potential exception of wetlands associated with springs SP_08, SP_09, and SP_39, impacts would be temporary for the reasons discussed above for ponds (overburden depth and clay substrate).

3.2.1.2.6 Reptiles

Reptiles would be minimally impacted, if at all, by changes in water flow and quality, as very few reptile species rely on riparian habitats. Species that commonly use riparian areas, such as the western terrestrial

garter snake, could potentially be impacted. However, this species is not restricted to riparian habitats, and would likely travel over terrestrial habitat until an alternative water source was encountered.

3.2.1.3 Alternative 3: Standard Lease Terms and Conditions and Special Stipulations

Under this alternative the tract would be leased with special coal lease stipulations for the MLNF in addition to the standard terms and conditions. These stipulations would eliminate or minimize subsidence and its potential effects on perennial drainages. Stipulations associated with aquatic resources include Forest Service Stipulations 3, 7, 9, and 17. Stipulation 3 requires that the lessee obtain baseline data to quantify the existing surface resources. Stipulation 7 requires that baseline data be used for future monitoring and evaluation of effects. Stipulation 9 requires that mining operations be conducted in a manner that would prevent surface subsidence, which could lead to escarpment failures and landslides as well as to damage or alterations of flow in perennial streams. Stipulation 17 requires that any ground or surface waters identified for protection that may be impacted by mining would have to be restored by the lessee in order to maintain riparian and fishery habitat, wildlife, and other uses.

3.2.1.3.1 Aquatic and Terrestrial Wildlife

Impacts to aquatic and terrestrial wildlife would be similar to those previously described for Alternative 2. However, the special stipulations for the protection of wildlife and perennial drainages described above would minimize the potential impacts to perennial streams, riparian vegetation, and wetland habitat under this alternative. The perennial streams in Muddy and Box canyons would be protected from mining under this alternative by shortening the length of and/or eliminating some of the longwall panels. Therefore, associated subsidence impacts to aquatic and terrestrial wildlife would not result. Since full longwall extraction of coal could still occur beneath isolated perennial segments of Cowboy Creek and Greens Hollow, impacts to wildlife discussed under Alternative 2 could still result. Impacts to riparian vegetation would be less than under Alternative 2, since Muddy Creek would not be undermined. However, impacts to riparian vegetation along Greens Hollow and Cowboy Creek could still occur. Impacts to ponds and wetlands associated with subsidence-induced tension cracks could still occur. However, risks of impacts to wetlands in Box Canyon and the small riparian zones associated with Box Canyon and Greens Canyon streams would be reduced because mining would not be allowed under these resources. Water depletion from the Colorado River system would not be expected since waters lost would be replaced. Therefore, formal consultation with FWS for the four endangered fish species would not be warranted.

3.2.2 Wildlife Issue 2

Subsidence of perennial streams could cause changes in stream morphology and aquatic habitat.

3.2.2.1 Alternative 1: No-Action

No leasing or mining would occur under this alternative. Subsidence of perennial streams would not occur under this alternative. Therefore, stream morphology and aquatic habitat would not be altered.

3.2.2.2 Alternative 2: Standard Lease Terms and Conditions Only

Mining activities under Alternative 2 would result in subsidence-induced ground movements and other changes in geology and topography in aquatic and terrestrial environments. These changes include variations in stream gradient, tension cracks, and rock failures. Subsurface disturbances could cause temporary cracks to open up in streambeds, which could divert flow underground. Temporary disruptions of ground and surface water flows could reduce water availability for aquatic species. Potential effects associated with changes in water flow are discussed above in section 3.2.1.2. In addition to these effects, subsidence could disturb escarpments in localized areas (MTI 2004), which could lead to major

disruptions of the natural sediment delivery process to streams (Nelson et al. 2003). This disturbance could also cause streambank erosion and instability in localized areas.

Perennial streams that would be undermined under Alternative 2 and thus may be affected by subsidence include Muddy Creek, perennial sections of Cowboy Creek, Greens Hollow, and Greens Canyon. The maximum expected change in stream gradient in Muddy Tract would be 3 percent, and the maximum expected subsidence of the streambed would be 7 feet at localized areas of Muddy Creek. In addition, cracks could be formed and escarpments could be disturbed in areas located near Box and Greens canyons (MTI 2004).

As discussed in the Surface and Ground Water Technical Report prepared for the Muddy Creek Tract, changes in surface elevation caused by subsidence would be expected to occur in areas of low overburden cover along Muddy Creek and Horse Creek. Localized changes in surface elevation would be likely to create ponding in areas where slope reductions occurred. Due to the nature of these streams, channel incision may occur in areas of increased slope, while sediment deposition and ponding would be expected downstream at the end of the subsidence zone. These changes in stream morphology could alter habitat for aquatic species. Changes in surface elevation could also occur along Greens Hollow and Cowboy Creek. However, since natural pools, steep segments, and large boulders occur along these channels, these changes may not be apparent and functional changes in channel morphology are not expected.

Potential impacts to specific species or groups are described below.

3.2.2.2.1 Fisheries

The cutthroat trout, thought to belong to the native Colorado River subspecies, is the only fish species of concern within the analysis area. This native species occurs in Muddy Creek and thus could be impacted by changes in stream morphology and aquatic habitat. The severity of these impacts depends on the magnitude of the disturbance of escarpments near streambeds, as well as to the potential changes in stream flow. A subsidence of 7 feet, the maximum expected at Muddy Creek, has the potential to affect fish movements above this stream reach, thus it could limit the access to spawning habitat in the upper sections of the stream, as well as in the South and North Forks of Muddy Creek. Further, if the degree of subsidence is such that flow would be interrupted, this obstruction could lead to the isolation and decline of the cutthroat trout populations in these areas. It would be unlikely that a gradient change of 3 percent could change the composition and ratios of habitat types (Schmidt 2004). Mitigation is recommended in section 3.3 to minimize potential impacts to fisheries habitat.

The natural input of sediment to streams is a normal component of salmonid habitat. However, increased sediment delivery to streams can cause major disruptions to the aquatic habitat. These disruptions can lead to the movement and redistribution of spawning gravels, additions of new sediments, changes in accessibility to fish of spawning habitats, changes in availability of food organisms, and changes in seasonal and diurnal water temperatures (Swanston 1991).

Additional inputs of sediment to streams, led by subsidence and the potential disturbance of escarpments near streambeds, could cause short-term and long-term changes to aquatic organisms and their habitat. Short-term impacts (days to months) could result in increases in availability, transport, and deposition of sediment. The accumulation of fine sediment on spawning gravels could reduce the availability of spawning habitat and reduce spawning/hatching success. Increasing the amounts of suspended and bedload sediments could reduce light penetration and thus photosynthesis and primary production, as well as reduce survival by delaying fish movements (migration), disrupting fish feeding and thus growth, interfering with respiration, and increasing gill irritation and the potential for infection. Conversely, long-term impacts (years to decades) include changes that may actually improve habitat quality and productivity by increasing the total area available for spawning and rearing habitat. The addition of

boulders, rubble, and gravel to the stream could lead to increases in habitat diversity and thus to the available habitat for fish. Obstructions caused by boulders and bedrock outcrops could modify channel velocity and direction, thus leading to the creation of pools, gravel bars, and side-channel rearing areas (Swanston 1991).

3.2.2.2.2 Macroinvertebrates

Aquatic macroinvertebrates depend on the flow of seasonal and perennial waters. As discussed above, higher abundance and diversity of macroinvertebrates are usually associated with cool water temperatures, substantial perennial flows, and diverse streambed substrate. Lower abundance and diversity are associated with ephemeral streams with high water temperature, low flow, and streambeds with large amounts of fine sediment.

Under this alternative, potential subsidence-induced changes in sediment inputs to Muddy Creek and Horse Creek and alterations in channel morphology could modify the species composition and abundance at a stream-reach scale. Potential increases to sediment loading in Greens Canyon could also affect macroinvertebrate communities. The estimated Biotic Condition Index indicated that this stream is in good condition (BCI >80). A reduction of 20 percent or more in the BCI would require further evaluation and possibly a change in management direction as required by the Standards and Guidelines defined in the Forest Management Plan for the MLNF (Forest Service 1986). The effects from subsidance on stream morphology within Greens Hollow and Cowboy Creek are expected to be minimal (MTI 2004). However, localized impacts to aquatic invertebrates could occur in these drainages. Changes in sediment input as well as changes in the number or distribution of pools in localized areas could lead to shifts in the composition and distibution of aquatic invertebrate communities at a small scale (e.g. habitat units and reaches). However, changes to invertebrate communities at a larger scale (e.g. drainages) are not expected. Potential effects on invertebrate communities from changes in water flow are discussed in section 3.2.1.2.2.

Potential damage from spall of escarpments also exists in areas located near Greens, Box, and Muddy canyons (MTI 2004). In these areas, increased bedload sediment could eliminate habitat for aquatic invertebrates, reduce abundance of invertebrates, and ultimately lead to reductions in fish production (Bjorn and Reiser 1991). Similar to the potential effects on fisheries discussed above, any damages to stream habitat could pose short-term and long-term effects. While short-term impacts may include the reduction in abundance and biodiversity of macroinvertebrates, the addition of boulders and rubble to the stream could result in a more complex habitat and thus increase species diversity in the long-term.

3.2.2.3 Alternative 3: Standard Lease Terms and Conditions and Special Stipulations

Under this alternative, the tract would be leased with special coal lease stipulations in addition to the standard terms and conditions, as described above in section 3.2.1.3. These stipulations would eliminate or minimize subsidence and its potential effects on perennial drainages and associated aquatic habitat.

3.2.2.3.1 Fish and Macroinvertebrates

Impacts to fish and macroinvertebrates would be similar as those previously described for Alternative 2 with the following exceptions. Special Stipulation 9 would prevent subsidence of perennial streams or escarpments thus eliminating associated impacts. Special Stipulation 17 would require the replacement of any waters lost due to the mining operation. Therefore, water depletion from the Colorado River system would not be expected, and formal consultation with FWS for the four endangered fish species would not be warranted.

3.2.3 Wildlife Issue 3

Exploration drilling and construction of mine vent holes could temporarily disrupt use of summer habitat by terrestrial species.

3.2.3.1 Alternative 1: No-Action

No leasing or mining would occur under this alternative. Exploration drilling and construction of mine vent holes would not occur. Therefore, use of summer habitat by terrestrial species would not be disrupted.

3.2.3.2 Alternative 2: Standard Lease Terms and Conditions Only

Mining activities under Alternative 2 would include coal exploration drilling and the construction of four mine vent holes and associated structures. Exploration drilling would occur at approximately 26 locations and would include the construction of associated drill pads, a staging area, and several short access roads. The majority of the drilling would be road supported, but helicopter supported drilling is proposed at three sites in canyon bottoms. Exploration activities are estimated to occur over 5 years and take place over a 2 month per year time period during the late summer and fall.

Disturbance associated with exploration drilling and construction of mine vent holes includes noise from equipment use and road travel. In addition, vegetation would be removed from small, localized areas. These areas would be reclaimed, but would constitute a temporary loss in wildlife habitat, and likely a change in vegetation type. The conceptual location of drill pads and roads, as depicted in the Geology Technical Report prepared for the Muddy Creek Tract (Plate 2), and the conceptual location of mine vent holes, as depicted in the Conceptual Mine Plan for the Muddy Tract (MTI 2002), were used as the basis for this analysis.

Total temporary disturbance due to exploration drilling would be approximately 17 acres. The approximate acres of disturbance associated with the construction of new roads, drill pads, and staging areas by vegetation type are depicted in Table 11.

Table 11. Habitat disturbance associated with exploratory drilling in the Muddy analysis area.

Vegetation Type[1]	Acres
Aspen	4.8
Sagebrush	4.3
Mahogany/Mountain Brush	4.1
Mixed Conifer	0.4
Limber Pine	0.3
Ponderosa Pine	0.2
Grassland	2.3
Pinyon/Juniper	0.1
Willow Riparian	0.1
Unidentified for staging areas	0.5
Total	16.6

[1]Vegetation types are defined in section 3.1.1.

Potential impacts associated with exploration drilling and construction of mine vent holes to wildlife are discussed below.

3.2.3.2.1 TEPS Fishes

Exploration drilling would use water supplied by a relay system of pumps, water lines, and tanks. The streams proposed for water use have not yet been determined, but they would likely occur in the analysis area in the Muddy and/or Quitchupah drainages. Since these streams eventually flow into the Colorado River via the San Rafael and Green rivers, use of water for drilling, if not replaced or otherwise mitigated, would result in minor depletions to the Colorado River system, and thus impacts to the four endangered fish species could result. Therefore, formal consultation with the FWS could be required under this alternative.

Two drill pads are proposed near Muddy Creek and the South Fork of Muddy Creek, and helicopter-supported drilling is proposed in the bottom of Muddy Canyon. If construction activities took place too close to the streams, potential impacts to habitat for cutthroat trout and other fishes could result. Mitigation is recommended in section 3.3 to minimize potential impacts to fisheries habitat.

3.2.3.2.2 TEPS Birds

Roads and drill pads associated with exploratory drilling would be in the vicinity of at least two goshawk territories and numerous flammulated owl territories. Noise associated with construction of roads and pads and with drilling could disrupt roosting and foraging behavior of these birds at the end of the nesting period. The magnitude of behavior modification would vary depending on the distance of the disturbance from the birds and nest sites, and the intensity and duration of the disturbance. Responses could vary from temporary startle responses (flush) and short avoidance flights, to longer-term avoidance of territories, and potential abandonment for a given year. As the majority of the exploratory drilling activities are not proposed to occur until late summer, the majority of the breeding season for these birds would be complete, and the young would be near, at, or past the fledgling stage. Mitigation is recommended in section 3.3 to minimize potential impacts to these species.

Drilling activities would not directly impact any other TEPS birds species. However, approximately 17 acres of habitat would be removed. Less than 5 acres occurs in each habitat type, thus the impact to wildlife foraging and nesting habitat would be negligible. Furthermore, these areas would be reclaimed, although the species composition would likely change. There would be no impacts to any TEPS bird species associated with construction of mine vent holes.

3.2.3.2.3 TEPS Mammals

There would be no direct impacts to TEPS mammal species from exploration drilling or construction of mine vent holes. There would be a minor reduction in habitat for moths, the primary prey species for spotted and Townsend's big-eared bats, but this impact would be negligible. Less than 6 acres of Canada lynx habitat would be removed. This impact would also be negligible. If a lynx were to use the tract as a travel corridor, it would be temporarily disturbed by noise associated with drilling, construction, and road use, but this species is not expected to occur in the analysis area.

3.2.3.2.4 MIS

One of the drill pad locations would be less than 0.25 miles from a golden eagle nest. The associated eagle pair could potentially be disturbed from the noise and human presence near this site, especially if the drill pad and road were visible from the nest site. Of the four proposed mine vent holes, three are in the vicinity of golden eagle nests. Noise associated with the construction of vent structures could temporarily disturb these pairs. Disturbance to eagles would likely be minor, if construction, road use, and drilling occurred late in or outside of the eagle breeding season. Mitigation is recommended in section 3.3 to minimize potential impacts to golden eagles.

The areas proposed for exploration drilling are associated with summer and winter range for mule deer and elk, primarily winter range. Deer and elk using these areas during the period of drilling activity could be temporarily disturbed. It is likely that they would avoid these areas at this time. Increased use of roads associated with exploratory drilling would also result during later summer and early fall, potentially resulting in vehicle-related mortality or habitat avoidance. Impacts of habitat removal and to available forage would be negligible since less than 17 acres of total habitat would be removed (and areas eventually reclaimed). Removal of habitat suitable for deer fawning and elk calving could occur. However, because so little of this habitat would be removed (less than 10 acres), these impacts are expected to be minor. Noise associated with the construction of vent structures could potentially disturb deer and elk in the analysis area. However, disturbance would be temporary. Noise from the operating vents would be continuous and audible. However, it is not expected to disturb these mammals, as they likely would become readily accustomed to it, as they are from the noise from the SUFCO Mine vents.

No impacts to macroinvertebrates are anticipated from exploration drilling or construction of vents. The only exception would be if the drill pads in the canyon bottoms or near perennial streams were too close to streams and impacted water quality. Mitigation is recommended in section 3.3 to minimize potential impacts to aquatic habitat.

3.2.3.2.5 Species of High Federal Interest

No impacts to migratory birds of high federal interest, other than those previously discussed for the golden eagle and flammulated owl, are anticipated from exploration drilling or construction of vents. Minor amounts of habitat would be removed for the construction of roads and drill pads (less than 17 acres total). However, the associated impact to bird habitat would be negligible.

3.2.3.2.6 Other Species

The locations of some of the drill pads and roads occur in potential habitat and near known locations of blue grouse. Therefore, drilling activities could potentially disturb grouse using the area. Disturbance would likely be short-term and include temporary displacement. No notable impacts to grouse habitat would occur.

The locations of some of the drill pads and roads are in the vicinity of a small number of ponds and springs in the analysis area. If drilling occurred in the ponds or springs, or associated hydric vegetation, amphibian habitat would be impacted. No drilling is proposed in the vicinity of the known boreal toad populations. Mitigation is recommended in section 3.3 to minimize potential impacts to amphibian habitat.

No impacts to reptiles, small mammals, or non-game birds are anticipated from exploration drilling or construction of vents. Minor amounts of habitat would be removed for the construction of roads and drill pads (< 17 acres total). However, the associated impact to wildlife habitat would be negligible.

3.2.3.3 Alternative 3: Standard Lease Terms and Conditions and Special Stipulations

Under Alternative 3, the tract would be leased with special coal lease stipulations in addition to the standard terms and conditions. Mining activities would include coal exploration drilling and the construction of four mine vent holes and associated structures. Exploration drilling would include the construction of associated drill pads, a staging area, and several short access roads. The number and location of drill pads and required time for exploration activities would likely be the same as under Alternative 2, since there would still be a need for geologic information throughout the tract.

3.2.3.3.1 Aquatic and Terrestrial Wildlife

Potential impacts to TEPS species, MIS, species of high federal interest, and other categories of wildlife would therefore be the same or similar to those outlined under Alternative 2, with two exceptions. The same mitigation measures suggested under Alternative 2 apply under this alternative.

Potential impacts to big-game species could be reduced under Special Stipulation 14. Measures could be put in place, as deemed necessary, that would curtail specific surface uses outside the mine development area during specified periods of the year in order to protect big-game wintering areas, elk calving and deer fawning areas, and other key wildlife habitat and/or activities. However, given that the impacts to deer and elk discussed under Alternative 2 were considered minor, implementation of such measures would unlikely be necessary.

Water depletion from the Colorado River system would not be expected under this alternative since under Special Stipulation 17, ground or surface waters identified for protection that may be impacted would have to be restored by the lessee in order to maintain riparian and fishery habitat, wildlife and other uses. Therefore, formal consultation with FWS for the four endangered fish species would not be warranted.

3.2.4 Wildlife Issue 4

Construction and operation of mine facilities and haul roads and coal traffic could remove habitat and associated noise/activity could displace dispersed wildlife (avoidance) including threatened, endangered, proposed, and sensitive species.

3.2.4.1 Alternative 1: No-Action

No leasing or mining would occur under this alternative. Construction and operation of mine facilities and haul roads and coal traffic would not occur. Therefore, habitat would not be removed and wildlife would not be displaced or dispersed from associated noise and mining activities.

3.2.4.2 Alternative 2: Standard Lease Terms and Conditions Only

Under Alternative 2, no mining facilities (storage units, offices, warehouses, truck loadouts, portals, conveyors, power lines, etc.) or roads would be constructed. Existing mining facilities and haul roads associated with the SUFCO mine would be used. These facilities are located outside of but adjacent to the analysis area. No aboveground mining activities would occur within the analysis area. Therefore, there would be no impacts to TEPS species, MIS, species of high federal interest, and other categories of wildlife associated with construction of mine facilities and hauling coal on haul roads. There would, however, be impacts to wildlife from subsidence of escarpments and spalling resulting from mine operations.

Escarpment failure could occur in lower Box Canyon, Greens Canyon, and Muddy Canyon, with the potential for failure considered very low, medium to high, and high, for the three canyons, respectively (MTI 2004). Potential impacts of escarpment failure and cliff face spalling are discussed below.

3.2.4.2.1 TEPS Fishes

Potential impacts to fish habitat from escarpment failure and spalling are discussed above in section 3.2.2.2.

3.2.4.2.2 TEPS Birds

Of the seven TEPS bird species discussed in this analysis, only the Mexican spotted owl and peregrine falcon use cliffs for nesting. Hypothetically, if escarpment failure were associated with a cliff nest site,

the nest would be destroyed and breeding success for the raptor would be reduced until a new nest were built. Only peregrine falcons are known to nest in the analysis area, and the nest site is outside of the tract and the potential area of subsidence. Therefore, no impacts to TEPS birds would occur.

3.2.4.2.3 TEPS Mammals

Spotted bats and Townsend's big-eared bats often roost in rock crevices on steep cliff faces. Spotted bats have been observed in Box Canyon, Greens Canyon, and Muddy Canyon, thus escarpment failure and cliff face spalling could reduce suitable habitat for this species. Roost habitat for big-eared bats would also be affected, although it is unlikely that this species occurs in the analysis area.

3.2.4.2.4 MIS

As discussed in section 3.4.2.2, escarpment failure could impact nest sites and breeding success of cliff-nesting raptors. Golden eagles nest on cliff faces in Box and Muddy canyons. Therefore, escarpment failure would impact this species.

Impacts to mule deer and elk from escarpment failure and spalling would be minor or non-existent. Potential impacts would be limited to isolated incidents of rocks or boulders falling on individuals below cliff faces.

Potential impacts to macroinvertebrate habitat from escarpment failure and spalling are discussed above in section 3.2.2.2.

3.2.4.2.5 Species of High Federal Interest

Migratory birds of high federal interest that use cliffs for nesting include golden eagles, peregrine falcons, prairie falcons, and Mexican spotted owls. Black swifts also may use cliff habitats. The potential impacts of Alternative 2 on golden eagles, peregrine falcons, and spotted owls were discussed earlier in this section. No black swifts are present in the analysis area, and their presence is unlikely. However, potential habitat could be impacted by escarpment failure. A prairie falcon nest occurs about 0.5 miles from the tract boundary in Muddy Canyon. This nest could potentially be impacted by escarpment failure. However, the nest is on the northern side of the canyon, reducing the potential for impact.

3.2.4.2.6 Other Species

Potential impacts from escarpment failure for other species would be minor to non-existent. There is the potential for small mammal or reptile burrows to be crushed from large boulders. However, these impacts would occur in localized areas and would not impact populations. No impacts to amphibian habitat are expected. Failure of escarpments and spalling of cliff faces could potentially impact other species of birds that use cliff faces and rocky habitats, such as ravens, canyon wrens, and rock wrens.

3.2.4.3 Alternative 3: Standard Lease Terms and Conditions and Special Stipulations

Under Alternative 3, the tract would be leased with special coal lease stipulations in addition to the standard terms and conditions. Forest Service Special Stipulations associated with wildlife resources include stipulations 2 and 9. Since no surface uses would occur in the analysis area, special stipulations 4 and 14 for wildlife would not apply. Stipulation 2 requires that the lessee conduct an intensive field inventory for threatened and endangered species and migratory bird species of high federal interest. These surveys were conducted and survey results were used in the development of the Conceptual Mine Plan for the Muddy Tract for this alternative (MTI 2002), so that impacts to cliff-nesting raptors were avoided. Stipulation 9 requires that mining operations be conducted in a manner that would prevent surface subsidence, which could lead to escarpment failures and landslides as well as to damage or alterations of flow in perennial streams.

3.2.4.3.1 Aquatic and Terrestrial Wildlife

As under Alternative 2, no mining facilities or roads would be constructed. Existing mining facilities and haul roads associated with the SUFCO mine would be used. No aboveground mining activities would occur in the analysis area. Therefore, there would be no associated impacts to TEPS species, MIS, species of high federal interest, and other categories of wildlife. In addition, special stipulation 9 defined above for Alternative 3 would eliminate the risk of escarpment failure. Therefore, impacts to wildlife associated with escarpment failure and cliff face spalling would not occur.

3.3 Mitigation and Monitoring Recommendations

- Include special stipulations to shorten longwall panels in order to prevent significant losses of surface and ground water flow in Muddy Creek.

- Conduct removal of debris, construction of fishways, and/or installation of culverts to enhance fish and aquatic habitat in areas that lose flow permanently, or where connectivity is interrupted as a result from subsidence (see Reeves et al. 1991).

- Conduct exploration drilling outside of streambeds and associated riparian areas (or riparian conservation areas or buffers, if defined) to reduce or eliminate potential impacts to aquatic habitat for fishes and macroinvertebrates.

- Conduct clearances for special status bird species (federally listed or proposed species, Forest Service sensitive species, MIS, and other raptors of federal interest) prior to mining activities. If species are observed, identify and map the location of nest sites.

- Implement seasonal and spatial buffers as described in Romin and Muck (1999) around any occupied goshawk, flammulated owl, golden eagle, or other known or identified raptor nest sites that may be impacted by mining-related activities.

- Conduct exploration drilling outside of/away from ponds, springs, and wetland habitats to reduce or eliminate potential impacts to amphibian habitat.

3.4 Cumulative Effects

Several land management activities have recently occurred, are currently occurring, or could occur in the near future in the Muddy analysis area. The activities that have the greatest potential to add cumulatively to the impacts of proposed mining on wildlife include cattle grazing, mining in the Pines Coal Tract, and recreation.

In general, livestock grazing poses a potential threat to aquatic habitat. Improper grazing practices can degrade streams, riparian habitats, and fish populations. It can also reduce the quality of habitat for terrestrial species associated with riparian systems. Degradation occurs when soils are compacted and the vegetation composition is changed. This can lead to increased runoff and erosion, reduced streambank vegetation and stability, changes to aquatic habitat, and adverse impacts to fish and other aquatic species (Platts 1991). Impacts from cattle grazing could add cumulatively to the impacts to aquatic habitat from mining-induced subsidence and escarpment failure.

Present and future mining activities in the Pines Coal Tract could affect fish and aquatic macroinvetebrate habitat in the Muddy Creek Tract, as small flow reductions and additional sediment inputs into Muddy

Creek are anticipated (Forest Service 1999). Potential escarpment failure and cliff-face spalling, and mining-induced tension cracks associated with this mining lease could also add cumulatively to the impacts to other aquatic and terrestrial wildlife. No disturbance to terrestrial wildlife associated with mining activities would occur since the above ground activities for the Pines Tract occur outside of the Muddy analysis area.

Recreation in the analysis area is associated primarily with hunting. Increased visitation and vehicle use during the hunting season could add cumulatively to disturbances associated with coal exploration activities.

4.0 LITERATURE CITED AND CONTACTS

Andrews, R., and R. Righter. 1992. Colorado Birds. Denver Museum of Natural History, Denver, CO.

Beck, D.L. 1980. Wintering bald eagles in the Wells Resource Area, Elko District, Nevada, 1970-1980. U.S. Department of the Interior, Bureau of Land Management.

Berg, L. 2002a. FAX addressed to Eric Duffin, Cirrus Ecological Solutions from Lois Berg, Aquatic Program Manager, Southeastern Region UDWR, regarding fish species presence in essential waters in Emery, Sanpete, and Sevier counties. May 10.

Berg, L. 2002b FAX addressed to Rebecca Thompson, Cirrus Ecological Solutions from Lois Berg, Aquatic Program Manager, Southeastern Region UDWR, regarding fish surveys in the Muddy, Quitchupah, Straight Canyon, and Cottonwood drainages. September 18.

Berg, L. 2002c Email addressed to Rebecca Thompson, Cirrus Ecological Solutions from Lois Berg, Aquatic Program Manager, Southeastern Region UDWR, regarding fish surveys in the Muddy, Quitchupah, Straight Canyon, and Cottonwood drainages. November 12.

Bjornn, T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in Streams. American Fisheries Society Special Publication 19:83-138.

BLM (USDI-Bureau of Land Management). 2003. Draft BLM Sage-Grouse Habitat Conservation Strategy. BLM Sage-Grouse Team, Washington, D.C. Released August 21, 2003.

Bond, F. M., G. R. Craig, J. H. Enderson, A. W. Heggen, J. V. Kussman, D. L. Wills, A. Jenkins, and J. P. Hubbard. 1984. American Peregrine Falcon: Rocky Mountain and Southwest Population Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado.

Colorado Division of Wildlife (CDOW). 2001. Colorado Gap Analysis Project, Colorado Division of Wildlife, Habitat Section. Web access: http://ndis.nrel.colostate.edu/cogap/gapframe.html.

Dalton, L.B., J.S. Price, and L.A. Romin. 1990. Fauna of Southeastern Utah and life requisites regarding their ecosystems. Publication No. 90-11. Utah Department of Natural Resources, Division of Wildlife Resources.

Ehrlich, P. R., D. S. Dobkin, and D. Wheye. 1988. The Birder's Handbook: A Field Guide to the Natural History of North American Birds. Simon and Schuster/Fireside Books, New York.

Forest Service (USDA Forest Service). 1986. Land and Resource Management Plan for the Manti-La Sal National Forest. 1986 version with 2003 revisions.

Forest Service. 1993. Draft northern goshawk survey protocol and data collection forms. USDA-FS, Intermountain Region, Ogden, Utah. June, 1993.

Forest Service. 1999. Final Environmental Impact Statement for the Pines Tract Project. Manti-La Sal National Forest. January.

Forest Service. 2002a. Vegetation for the Manti-La Sal National Forest, Manit/Sanpitch Divisions. Manti-La Sal National Forest. April 22. <http://www.fs.fed.us/r4/mantilasal/downloads/mantiveg.e00>

Forest Service. 2002b. Manti-La Sal National Forest News Release. Evidence of Canada Lynx Found on Manti-La Sal National Forest. 3 September.

Forest Service 2003a. Manti-La Sal National Forest coal lease special stipulations. United States Department of Agriculture Forest Service. Manti-La Sal National Forest, Price, Utah.

Forest Service. 2003b. Intermountain Region Proposed, Endangered, Threatened, and Sensitive Species. Known/Suspected Distribution by forest. December 2003.

FWS (USDI Fish and Wildlife Service). 2002. Federally Listed and Proposed (P), Endangered (E), Threatened (T), and Candidate (C) Species and Habitat in Utah By County, dated August 2002. Salt Lake City, UT.

Hart, J.M. and L.N. Berg. 2003. Colorado River cutthroat trout conservation and management in the Southeastern Region during 2002. Project F-44-R. Utah Department of Natural Resources, Division of Wildlife Resources, Salt Lake City. June.

Hawkins, C. J. Ostermiller, and M. Vinson. 1998. Stream Invertebrate Sampling and Environmental Sampling Associated with Biological Water Quality Assessments: Field Protocols. Department of Fisheries of Wildlife and BLM National Aquatic Monitoring Center, Utah State University, Logan, UT. June.

Hodson, R. 2004. Personal communication between Rebecca Thompson, Cirrus Ecological Solutions and Ron Hodson, Wildlfie Biologist, Northern Region Utah Division of Wildlife Resources, regarding potential elk calving habitat in the Muddy analysis area. February 19.

Jewkes, J. 2004a. Personal communication between Rebecca Thompson, Cirrus Ecological Solutions and Jeff Jewkes, Wildlife Biologist, Ferron Ranger District, regarding goshawk territory occupancy on the Manti-La Sal National Forest.

Jewkes, J. 2004b. Digital coverage of modeled elk calving grounds emailed to Rebecca Thompson, Cirrus Ecological Solutions from Jeff Jewkes, Wildlife Biologist, Ferron Ranger District. February 23.

Johnson, A., and D. Janetski. 2003. Field trip report: Quitchupah Creek and Water Hollow tributary. Report to the Utah Division of Wildlife Resources. Salt Lake City, Utah.

Koehler, G. M. 1990. Population and habitat characteristics of lynx and snowshoe hares in north central Washington. Canadian Journal of Zoology 68:845-851.

Lentsh, L., Y. Converse, and J. Perkins. 1997. Conservation agreement and strategy for Bonneville cutthroat trout (*Oncorhynchus clarki Utah*) in the state of Utah. Utah Division of Wildlife Resources, Publication 97-19, Salt Lake City, Utah.

Licht, L. 1986. Food and feeding behavior of sympatric red-legged frogs, *Rana aurora*, and spotted frogs, *Rana pretiosa*, in southwestern British Columbia. Canadian Field Naturalist 100: 22-31.

Mowat, G, K., G. Poole, and M. O'Donoghue. 2000. Ecology of lynx in northern Canada and Alaska. Chapter 9 in Ruggiero, L. F., K. B. Aubry, S. W. Buskirk [and others]. Ecology and conservation of lynx in the United States. University Press of Colorado, Boulder, CO. 480 p.

MTI. 2002. Conceptual Mine Plan for the Muddy Creek Tract. Prepared by Maleki Technologies, Inc. Spokane WA. Prepared for Cirrus Ecological Solutions, LC.

MTI. 2004. Assessment of the effects of surface impacts resulting from longwall mining in the Muddy Tract, Utah. Report to Cirrus Ecological Solutions, Logan, Utah, 2004. Maleki Technologies, Inc, Spokane, Washington.

NatureServe Explorer: An online encyclopedia of life [web application]. 2002. Version 1.6 . Arlington, Virginia, USA: NatureServe. Available: http://www.natureserve.org/explorer. (Accessed: January 2003).

Nelson, R.L., McHenry, M.L., and W.S.Platts. 1991. Mining. American Fisheries Society Special Publication 19:425-457.

Oliver, G. 2001. Zoologist, Utah Division of Wildlife Resources. Personal communication with R. Thompson, Cirrus Ecological Solutions, regarding audible detections of bats. October.

Oliver, G. V. 2000. The bats of Utah: A literature review. Utah Division of Wildlife Resources, Salt Lake City. Publication 00-14. 141 pages.

Osmundson, D.B., and L.R. Kaeding. 1991. Flow recommendations for maintenance and enhancement of rare fish habitat in the "15 mile" reach during October-June. Final Report. U.S. Fish and Wildlife Service, Grand Junction, CO.

Perkins, J.M. and J.R. Peterson. 1997. Bat survey for the SUFCO mine, Emery County, Utah. September, 1997. Salt Lake City, Utah.

Peterson, R. T. 1990. A Field Guide to Western Birds. The Peterson Field Guide Series. Houghton Mifflin Company, Boston.

Platts, W.S. 1991. Livestock grazing. American Fisheries Society Special Publication 19: 389-423.

Reeves, G.H., Hall, J.D., Roelofs, T.D., Hickman, T.L., and C.O.Baker. 1991. American Fisheries Society Special Publication 19:519-556.

Reynolds, R. T., and B. D. Linkhart. 1987. The nesting biology of flammulated owls in Colorado. Pages 239-309 in Biology and Conservation of Northern Forest Owls, Symposium Proceedings. USDA-Forest Service, Fort Collins, CO. Gen. Tech. Rep. RM-142.

Reynolds, R.T., R.T. Graham, M.H. Reiser, R.L. Basselt, P.L. Kennedy, D.A. Boyce Jr., G. Goodwin, R. Smith, and E.L. Fisher. 1992. Management recommendations for the northern goshawk in the southwestern United States. Rocky Mountain Forest and Range Experiment Station, South-west Region Forest Service. USDA Forest Service, General Technical Report GTR-RM-217. 90 pp.

Rodriquez 1998. Life History and Analysis of Endangered, Threatened, Candidate, Sensitive, and Management Indicator Species of Dixie National Forest. Dixie National Forest, Cedar City, Utah. March.

Romin, L.A. and J.A. Muck. 1999. Utah Field Office Guidelines for Raptor Protection from Human and Land Use Distrubances. US Fish and Wildlife Service, Salt Lake City, Utah.

Ruediger, B., J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G. Patton, T. Rinaldi, J. Trick, A. Vandehey, F. Wahl, N. Warren, D. Wenger, and A. Williamson. 2000. Canada Lynx Conservation Assessment and Strategy. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Missoula, MT.

Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, L. J. Lyon, W. J. Zielinski. 1994. The Scientific Basis for Conserving Forest Carnivores. American Martin, Fisher, Lynx, and Wolverine in the Western United States. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. General Technical Report RM-254.

Sauer, J.R., J.E. Hines, and J. Fallon. 2003. The North American Breeding Bird Survey, Results and Analysis 1966 - 2002. Version 2003.1, USGS Patuxent Wildlife Research Center, Laurel, MD.

Schmidt, J. 2004. Associate professor. Department of Aquatic, Watershed, & Earth Resources Utah State University, Logan, Utah. Personal communication.

Sigler, W.F., and J.W . Sigler. 1996. Fishes of Utah: a natural history. University of Utah Press. Salt Lake City, Utah. 375pp.

Spahr, R., L. Armstrong, D. Atwood, and M. Rath. 1991. Threatened, Endangered, and Sensitive Species of the Intermountain Region, USDA-Forest Service, Intermountain Region, Ogden, UT.

Swanston, D.N. 1991. Natural Processes. American Fisheries Society Special Publication 19:139-179.

Thomas, J.W., H. Black, R.J. Scherzinger, and R.J. Pedersen. 1979. Deer and Elk. Chapter 8 *in* Wildlife Habitats in Managed Forests: The Blue Mountains of Oregon and Washington. USDA Forest Service, Agricultural Handbook 553.

Toone, R. 1993. General inventory for spotted bats (*Euderma maculatum*) on the Wasatch Plateau, Manti-La Sal National Forest, and the Old Woman Plateau and Thousand Lakes Mountain, Fishlake National Forest. Utah Natural Heritage Program, Utah Department of Natural Resources, Salt Lake City. January.

Tyus, H.M. 1987. Distribution, reproduction, and habitat use of the razorback sucker in the Green River, Utah, 1979-1986. Transactions of the American Fisheries Society 116:111-116.

UDWR (Utah Division of Wildlife Resources). 1992. Forest Owl Inventory Protocol. Utah Department of Natural Resources, Division of Wildlife Resources. Received from the Manti-La Sal National Forest, 2001.

UDWR. 1997. Inventory of Sensitive Species and Ecosystems in Utah. Inventory of Sensitive Vertebrate and Invertebrate Species: A Progress Report. Department of Wildlife Resources. September 30.

UDWR. 2001a. Elk aerial census data from January 2001 in the South Muddy, North Muddy/Ferron, North Horn, and South Horn. Received from Ron Hodson, Wildlife Manager for the Northern Region. Feb 2004.

UDWR. 2001b. Utah big game annual report - 2001. Utah Department of Natural Resources, Utah Division of Wildlife Resources Publication Number 01-30. December 14.

UDWR and UNHP (Utah Natural Heritage Program). 1992. Northern three-toed woodpecker (*Picoides tridactylus dorsalis*) inventory protocol. Received from the Manti-La Sal National Forest, 2001.

Utah Conservation Data Center (UCDC). 2003. Utah Division of Wildlife Resources, UCDC Web home page, species information and Utah distribution maps. Available: http://www.utahcdc.usu.edu/ucdc.

Utah Gap Analysis: An Environmental Information System. 1997. USDI National Biological Service and Utah State University. Contains species-specific maps depicting predicted critical, high value, substantial value, and limited value habitat in Utah. (http://dwrcdc.nr.utah.gov/ucdc/).

Utah Gap Analysis: An Environmental Information System: DWR Neotrops Revision. 1999. USDI National Biological Service and Utah State University. Contains species-specific maps depicting breeding and wintering habitat in Utah. (http://dwrcdc.nr.utah.gov/ucdc/).

Vinson, M. 2002a. Aquatic Macroinvertebrate Monitoring Report, Manti-La Sal National Forest, June 2001 - August 2001. National Aquatic Monitoring Center, Department of Aquatic, Watershed, and Earth Resources, Utah State University, Logan Utah. February.

Vinson, M. 2002b. Aquatic Macroinvertebrate Monitoring Report, Manti-La Sal National Forest, May 2002 - September 2002. National Aquatic Monitoring Center, Department of Aquatic, Watershed, and Earth Resources, Utah State University, Logan Utah. December.

Vinson, M. 2004. Aquatic Macroinvertebrate Monitoring Report for Greens, Cowboy, and White Mountain Cabin Creeks. June 2001 - September 2003. National Aquatic Monitoring Center, Department of Aquatic, Watershed, and Earth Resources, Utah State University, Logan Utah. January.

Wai-Ping, V. and M.B. Fenton. 1989. Ecology of spotted bat (*Euderma maculatum*): roosting and foraging behavior. Journal of Mammalogy. 70(3):617-622.

Wiley, D.W. 1992. Distribution and habitat ecology of Mexican spotted owls on the Colorado Plateau: Ann. Rep. 1991-1992. Utah Div. Wildl. Res. Salt Lake City, UT.

5.0 LIST OF PREPARERS WITH QUALIFICATIONS OF PREPARERS

Rebecca Thompson (MS), Lead Wildlife Biologist, Cirrus Ecological Solutions, LC. Ms. Thompson has over nine years of experience in wildlife and forest ecology. She has worked in a wide array of natural systems, from coastal Oregon and Washington to the Intermountain West. Her graduate work at Oregon State University focused on habitat associations of red-backed voles and other small mammal species. Her work with the Forest Service focused on collection and analysis of aquatic vertebrate assemblages. Her work with the BLM included NEPA analysis of recreation and road improvement projects; managing wildlife habitat development projects; and coordinating and conducting timber sale clearance surveys for threatened, sensitive, and special status species. As a consultant she has functioned as the lead wildlife biologist and as a resource specialist on a variety of natural resource management projects (ski area developments/expansions, recreation permits, coal mining, grazing permits, and housing developments), conducting NEPA analyses and wildlife field surveys. She has conducted wildlife and botanical field surveys in range, forest, and riparian environments. Her field experience includes: wildlife field surveys for terrestrial and aquatic amphibians, small and arboreal mammals, mollusks, neo-tropical migrant birds, and federally listed threatened species and Forest Service sensitive species, and botanical surveys for vegetation community classifications (habitat typing) in sagebrush and subalpine habitats.

Anne Brown (MS), Wildlife Biologist, Cirrus Ecological Solutions, LC. Ms. Brown has 10 years of professional experience with wildlife and other natural resources in a wide variety of ecosystems ranging from forests to deserts to wetlands to agricultural systems, throughout North America. Her graduate work at Utah State University focused on sage grouse chick foraging ecology in sagebrush grasslands. Her extensive field experience includes point-count and broadcast avian surveys, nest searches and monitoring, behavioral observations, mist-netting, banding, color-marking, radio-tagging, and radio-tracking of various bird species, including passerines, game birds, hawks, and owls. She was also involved in small mammal, big game, and predator research. More recently, she assisted with water quality sampling of springs and the collection and processing of hydrologic data. She has demonstrated expertise with data analysis, technical writing, and editing.

Ernesto A. de la Hoz (MS), Aquatic Ecologist, Cirrus Ecological Solutions, LC. Mr. de la Hoz has over 7 years of experience in fisheries biology and aquatic ecology. He has worked in a wide variety of natural systems from Caribbean coral reefs to glacially formed lakes in the Intermountain West. His technical expertise includes fisheries biology, aquatic ecology, water quality, ichthyology, aquaculture, and modeling. He has worked on projects with sensitive/endangered species components and prepared environmental documents for government agencies in the U.S. and South America. In addition, Mr. de la Hoz has participated in stream, lake, coastal, and marine monitoring programs, water quality assessments, natural resource inventories, and numerous other fishery and aquatic ecology research projects. He holds a B.S. degree in Marine Biology from the University of Bogota- Jorge Tadeo Lozano (Colombia), a 2nd B.S. degree in Fisheries and Wildlife Management, and a M.S. degree in Ecology from Utah State University.

In addition to the list of preparers above, the following people (former Cirrus employees) assisted with wildlife field data collection and data analysis for this project:

- Don McIvor, Lead Wildlife Biologist and Crew Leader in 2001.
- Creed Clayton, Wildlife Technician and Crew Leader in 2001.
- Sunny McBride, Wildlife Technician in 2001.

6.0. APPENDICES: SUPPORTING DATA

Appendix A. Wildlife survey figures.

Appendix B. Macro-invertebrate taxa collected in the Muddy analysis area, 2001-2003.

Appendix C. Wildlife species observed in the Muddy analysis area, 2001-2003.

Appendix D. Small mammals.

Appendix E. Non-game birds.

APPENDIX A. WILDLIFE SURVEY FIGURES

APPENDIX B.
MACRO-INVERTEBRATE TAXA COLLECTED IN THE MUDDY ANALYSIS AREA, 2001-2003.

Order	Family	Subfamily/Genus/species
Phylum: Annelida		
Class: Oligochaeta		
Lumbriculida	Lumbriculidae	Lumbriculus
Phylum: Arthropoda		
Class: Arachnida		
Trombidiformes		
Class: Entognatha		
Collembola		
Class: Insecta		
Coleoptera		
Coleoptera	Dryopidae	Helichus
Coleoptera	Dytiscidae	
Coleoptera	Dytiscidae	Agabus
Coleoptera	Dytiscidae	Oreodytes
Coleoptera	Dytiscidae	Stictotarsus
Coleoptera	Elmidae	
Coleoptera	Elmidae	Optioservus
Coleoptera	Elmidae	Optioservus divergens
Coleoptera	Hydrophilidae	
Coleoptera	Hydrophilidae	Ametor
Coleoptera	Hydrophilidae	Berosus
Coleoptera	Hydrophilidae	Paracymus
Diptera		
Diptera	Ceratopogonidae	
Diptera	Ceratopogonidae	Bezzia
Diptera	Ceratopogonidae	Culicoides
Diptera	Ceratopogonidae	Probezzia
Diptera	Chironomidae	
Diptera	Chironomidae	Chironominae
Diptera	Chironomidae	Orthocladiinae
Diptera	Chironomidae	Tanypodinae
Diptera	Culicidae	
Diptera	Culicidae	Culiseta
Diptera	Dixidae	
Diptera	Dixidae	Dixa
Diptera	Dixidae	Dixella
Diptera	Dixidae	Meringodixa
Diptera	Dolichopodidae	
Diptera	Empididae	
Diptera	Empididae	Chelifera
Diptera	Empididae	Clinocera
Diptera	Empididae	Hemerodromia
Diptera	Empididae	Oreogeton
Diptera	Empididae	Wiedemannia
Diptera	Ephydridae	
Diptera	Muscidae	
Diptera	Psychodidae	Pericoma
Diptera	Ptychopteridae	Ptychoptera
Diptera	Simuliidae	
Diptera	Simuliidae	Metacnephia
Diptera	Simuliidae	Prosimulium
Diptera	Simuliidae	Simulium
Diptera	Stratiomyidae	
Diptera	Stratiomyidae	Caloparyphus
Diptera	Stratiomyidae	Euparyphus
Diptera	Tabanidae	
Diptera	Tabanidae	Chrysops
Diptera	Tabanidae	Tabanus
Diptera	Tipulidae	
Diptera	Tipulidae	Dicranota

Order	Family	Subfamily/Genus/species
Diptera	Tipulidae	Hexatoma
Diptera	Tipulidae	Ormosia
Diptera	Tipulidae	Pedicia
Diptera	Tipulidae	Tipula
Ephemeroptera		
Ephemeroptera	Ameletidae	Ameletus
Ephemeroptera	Baetidae	
Ephemeroptera	Baetidae	Acentrella
Ephemeroptera	Baetidae	Baetis
Ephemeroptera	Baetidae	Callibaetis
Ephemeroptera	Baetidae	Diphetor hageni
Ephemeroptera	Baetidae	Fallceon quilleri
Ephemeroptera	Ephemerellidae	
Ephemeroptera	Ephemerellidae	Drunella
Ephemeroptera	Ephemerellidae	Drunella coloradensis
Ephemeroptera	Ephemerellidae	Drunella doddsi
Ephemeroptera	Heptageniidae	
Ephemeroptera	Heptageniidae	Cinygmula
Ephemeroptera	Heptageniidae	Epeorus
Ephemeroptera	Heptageniidae	Rhithrogena
Ephemeroptera	Leptohyphidae	
Ephemeroptera	Leptohyphidae	Tricorythodes
Ephemeroptera	Leptophlebiidae	
Ephemeroptera	Leptophlebiidae	Paraleptophlebia
Ephemeroptera	Siphlonuridae	
Ephemeroptera	Siphlonuridae	Siphlonurus
Hemiptera	Gerridae	
Hemiptera	Gerridae	Aquarius
Plecoptera		
Plecoptera	Capniidae	
Plecoptera	Chloroperlidae	
Plecoptera	Chloroperlidae	Suwallia
Plecoptera	Nemouridae	
Plecoptera	Nemouridae	Malenka
Plecoptera	Nemouridae	Zapada
Plecoptera	Nemouridae	Zapada cinctipes
Plecoptera	Nemouridae	Zapada columbiana
Plecoptera	Perlodidae	
Plecoptera	Perlodidae	Isoperla
Plecoptera	Taeniopterygidae	
Trichoptera		
Trichoptera	Brachycentridae	
Trichoptera	Brachycentridae	Brachycentrus
Trichoptera	Brachycentridae	Brachycentrus americanus
Trichoptera	Brachycentridae	Micrasema
Trichoptera	Hydropsychidae	
Trichoptera	Hydropsychidae	Hydropsyche
Trichoptera	Hydropsychidae	Parapsyche
Trichoptera	Hydroptilidae	
Trichoptera	Hydroptilidae	Hydroptila
Trichoptera	Hydroptilidae	Leucotrichia
Trichoptera	Limnephilidae	
Trichoptera	Limnephilidae	Hesperophylax
Trichoptera	Limnephilidae	Limnephilus
Trichoptera	Limnephilidae	Onocosmoecus
Trichoptera	Rhyacophilidae	Rhyacophila
Trichoptera	Rhyacophilidae	Rhyacophila alberta
Trichoptera	Rhyacophilidae	Rhyacophila brunnea
Trichoptera	Uenoidae	Neophylax
Trichoptera	Uenoidae	Neothremma
Trichoptera	Uenoidae	Oligophlebodes
Class: Maxillipoda		
Cyclopoida		
Harpacticoida		
Class: Maxillipoda, subclass copepoda		
Class: Ostracoda		
Podocopida		

Order	Family	Subfamily/Genus/species
Phylum: Mollusca		
Class: Bivalvia		
Veneroida	Pisidiidae	
Veneroida	Pisidiidae	Pisidium
Class: Gastropoda		
Basommatophora	Lymnaeidae	
Phylum: Nemata		
Phylum: Platyhelminthes		
Class: Turbellaria		

A total of 126 taxa were collected in 49 samples.

APPENDIX C. WILDLIFE SPECIES OBSERVED IN THE MUDDY ANALYSIS AREA, 2001 - 2003.

Birds

American crow
American dipper
American goldfinch
American kestrel
American robin
Ash-throated flycatcher
Bald eagle
Black-billed magpie
Black-capped chickadee
Black-chinned hummingbird
Black-headed grosbeak
Blue grouse
Brewer's blackbird
Brewer's sparrow
Broad-tailed hummingbird
Brown creeper
Brown-headed cowbird
Canyon wren
Chipping sparrow
Clark's Nutcracker
Cliff swallow
Common nighthawk
Common poorwill
Common raven
Cooper's hawk
Dark-eyed junco
Downy woodpecker
Dusky/Hammond's flycatcher
Evening grosbeak
Flammulated owl
Flycatcher sp.
Golden eagle
Gray flycatcher
Gray jay
Gray vireo
Great horned owl
Green-tailed towhee
Hairy woodpecker
Hermit thrush
House wren
Killdeer
Lincoln's sparrow
Long-eared owl
MacGillivray's warbler
Mallard
Mountain bluebird
Mountain chickadee
Mourning dove
Northern flicker
Northern goshawk
Northern pintail
Northern pygmy-owl
Northern saw-whet owl
Olive-sided flycatcher
Orange-crowned warbler
Peregrine falcon
Pine grosbeak
Pine siskin
Pinyon jay
Prairie falcon (nest)
Red-breasted nuthatch
Red-naped sapsucker
Red-tailed hawk
Rock wren
Ruby-crowned kinglet
Ruffed grouse
Sage-grouse
Sage thrasher
Sharp-shinned hawk
Short-eared owl
Song sparrow
Sora
Spotted sandpiper
Spotted towhee
Steller's jay
Three-toed woodpecker
Townsend's solitaire
Tree swallow
Turkey vulture
Vesper sparrow
Violet-green swallow
Vireo sp.
Warbling vireo
Western kingbird
Western meadowlark
Western scrub jay
Western tanager
Western wood-peewee

Bird, continued

White-crowned sparrow
White-throated swift
Williamson's sapsucker
Yellow warbler
Yellow-rumped warbler

Mammals

Badger
Beaver
Black bear
Black-tailed jackrabbit
Bushy-tailed woodrat
Cliff chipmunk
Cougar
Coyote
Elk
Golden-mantled ground squirrel
Moose
Mountain cottontail
Mule deer
Northern grasshopper mouse
Porcupine
Red squirrel
Snowshoe hare
Spotted bat
Uintah chipmunk
Uintah ground squirrel
Unidentified chipmunk species
Unidentified ground squirrel species
Unidentified pocket gopher species
White-tailed jackrabbit
Yellow-bellied marmot

Amphibians

Great basin spadefoot toad
Striped chorus frog
Tiger salamander

Reptiles

Eastern fence lizard
Sagebrush lizard
Short-horned lizard
Tree lizard
Unidentified garter snakes
Western terrestrial garter snake

APPENDIX D. SMALL MAMMALS.

Small Mammal Species Potentially Occurring in the Muddy Analysis Area.

Species	Ecological Association[1]	Elevation Range (CO)[2]	Habitat[3]	Relative Abundance[4]	County Record[5]	Predicted Habitat[6]	Occurrence Expected[7]	Comments[8]
Masked shrew	all elevations	5,000-11,000	Prefers moist (riparian) habitats in mountainous areas	c	Unknown	Yes	Yes	
Merriam's shrew	submontane /montane	4,500-9,600	Dry habitats, especially sagebrush; also grasslands, mixed woodlands	u	No	Yes	Possible	Presumed statewide
Montane shew	all elevations	5,300-11,500	Boreal forests and alpine habitats in mountainous areas	c	Yes	Yes	Yes	
Dwarf shrew	submontane /montane	5,300-10,000	Rocky habitats in alpine tundra or subalpine conifer forests, talus slopes	k	No	Yes	No	Poorly known, seemingly very rare
Northern water shrew	submontane /montane	3,000-12,500	Near mountain streams, lakes, and marshes	c	Yes	Yes	Yes	Common in Utah
Vagrant shrew	submontane /montane	Not mentioned	Near water	c	Unknown	Yes	Yes	
Pallid bat	desert /submontane	3,000-7,000	Arid desert and grassland habitats, near water and rocky cliffs; also buildings	c	Unknown	Yes	Yes	
Big brown bat	submontane /montane	3,000-10,000	Forests and urban areas; caves, mines, rock crevices, trees, buildings	c	Yes	Borderline	Yes*	Widespread and common
Spotted bat	desert /submontane	Not mentioned	Desert, shrub steppe, moutain grassland or woodland; near cliffs	k	No	No	Observed	Rare, presence possible
Silver-haired bat	montane	4,500-9,500	Forests/woodlands near water	c	Yes	Yes	Yes*	Common in Utah
Red bat	submontane	3,000-5,000	Wooded areas near water, caves	r	No	Yes	No	Rarest bat in Utah
Hoary bat	submontane /montane	3,000-10,000	Woodland habitats, roosts in trees	u	Unknown	Yes	Yes	Widespread and common
California myotis	all elevations	4,500-7,500	Rock crevices, caves, buildings; forages near trees or over water	c	Unknown	No	Yes*	
Long-eared myotis	submontane /montane	4,000-9,000	Prefers forested areas with rocky outcrops; also caves, mines, buildings	c	Unknown	Yes	Yes*	Statewide, fairly common
Small-footed myotis	all elevations	4,000-8,500	Wide variety of habitats, mostly forested; trees, crevices, caves, mines	u	Yes	Yes	Yes*	Statewide but uncommon

Small Mammal Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Relative Abundance[4]**	**County Record[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Little brown bat	all elevations	5,000-11,000	Buildings, caves, trees, mines; forages near trees and water	c	Unknown	Yes	Yes*	Widespread and common
Fringed myotis	desert /submontane	3,000-7,500	Desert to woodland habitats; caves, mines, rock crevices, buildings	u	No	No	Possible	Widely distributed but seemingly rare in Utah
Long-legged myotis	all elevations	4,000-12,500	Pine forests, deserts, riparian habitats; buildings, crevices, trees, mines	c	Unknown	Yes	Yes	Widespread and fairly abundant in Utah
Yuma myotis	desert /submontane	3,000-6,000	Various habitats near open water; caves, bridges, old buildings, mines	u	Unknown	Borderline	Yes*	Not overly abundant in Utah
Western pipistrelle	desert /submontane	3,000-6,000	Desert and rocky habitats near water, canyons; crevices, mines, caves, buildings	c	Yes	Borderline	Yes*	
Townsend's big-eared bat	all elevations	3,000-9,500	Many habitat types, usually near forested areas; needs caves or mines	c	Yes	Yes	Possible	Statewide, moderately common, vulnerable to disturbance, thought to be declining
Brazilian free-tailed bat	desert /submontane	3,000-9,500	Mostly warm, low, open habitats, including urban areas; caves, buildings	r	Yes	Yes	Possible	Widely distributed in Utah and seemingly common
Ringtail	desert /submontane	3,000-9,500	Rocky deserts and woodlands, with cliffs and rocky outcrops, usually near water	c	Yes	Yes	Possible	Widespread in Utah but seemingly rare, usually below 6000 ft
Raccoon	desert /submontane	3,000-10,000	Wooded areas near water	c	Unknown	Yes	Yes	Common in Utah in suitable habitat
Marten	montane	9,000-12,000	Late-successional coniferous forests in remote mountainous areas	k (extirpated)	No	Yes	No	Limited distribution and abundance in Utah; thought to be extirpated in the Wasatch Plateau area
Ermine	submontane /montane	3,000-10,000	Prefers heavily wooded areas along streams	u	Unknown	Yes	Yes	Relatively common in Utah
Long-tailed weasel	all elevations	3,000-14,500	Habitat generalist: occurs in numerous habitat types; tolerant of human presence	c	Yes	Yes	Yes	Common throughout Utah
Black-footed ferret	desert /submontane	3,000-10,000	Associated with prairie dog towns, for prey and den sites	k	No	Borderline	No	Considered extinct as a naturally occuring species but may still exist in Utah; endangered

Small Mammal Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Relative Abundance[4]**	**County Record[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Mink	submontane /montane	3,000-14,500	Wetlans, marshes, and riparian areas, particularly near forested areas	l	Unknown	Yes	Possible	
Badger	all elevations	4,500-14,500	Open areas such as grasslands and deserts, with sufficient soil for burrowing	c	Yes	Yes	Observed	Common in appropriate habitat throughout Utah
Striped skunk	all elevations	3,000-10,000	Forest edges and open areas with sufficient soil for burrowing; also urban areas	c	Yes	Yes	Yes	Statewide, common
Spotted skunk	all elevations	4,000-8,000	Rocky, brushy areas	c	Unknown	Yes	Yes	Throughout Utah
River otter	all elevations	4,000-12,500	Riparian habitats, from montane forests to desert canyons	r	No	No	No	Natural populations very low in Utah; reintroduced in some areas
Yellow-bellied marmot	submontane /montane	5,400-14,500	Rocky areas and meadows near forested areas	c	Yes	Yes	Observed	Common in Utah
White-tailed prairie dog	all elevations	3,000-10,000	Open areas with well-drained soil for burrowing	l	Yes	Borderline	Possible	NE part of Utah
Utah prairie dog	Not mentioned	Not mentioned	Open areas below 9,000 ft with non-alkaline soils and succulent vegetation	Not mentioned	Yes	No	No	State threatened, endemic to SW Utah
White-tailed antelope squirrel	desert /submontane	4,500-7,000	Desert and shrubland areas with sparse vegetation, rocky or gravelly soil	c	Yes	Yes	Yes	Common throught most of Utah
Uintah ground squirrel	submontane /montane	Not mentioned	Open, well-drained meadows, grasslands, and cultivated fields near water	c	Yes	Yes	Observed	Common in suitable habitat within its range
Golden-mantled ground squirrel	submontane /montane	5,200-12,500	Rocky outcrops and talus slopes, open forests at high elevation and alpine tundra	c	Yes	Yes	Observed	Common in Utah
Rock squirrel	desert /submontane	3,000-8,300	Rocky habitats	c	Yes	Yes	Yes	
Cliff chipmunk	all elevations	5,500-7,000	Cliff dwellers in many types of habitats ranging from saltbrush to pine forests	u	Yes	Yes	Observed	Common in many types of habitats
Least chipmunk	all elevations	5,500-12,000	Many types of habitats, ranging form deserts to mountain forests	c	Yes	Yes	Yes	Widespread in Utah
Uintah chipmunk	submontane /montane	6,500-12,000	Talus slopes and openings in coniferous forests, or forest edges	c	Unknown	Yes	Observed	Common in mountainous areas of Utah

Small Mammal Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Relative Abundance[4]**	**County Record[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Hopi chipmunk	Not mentioned	4,500-8,000	Prefers rocky habitats, especially with pinyon-juniper woodlands	Not mentioned	Unknown	Yes	Possible	Common in SE Utah
Red squirrel	montane	6,000-12,000	Dense stands of montane coniferous forests	c	Unknown	Yes	Observed	Common to the forests of Utah
Northern flying squirrel	montane	Not mentioned	Mountainous areas, primarily in mature coniferous forests and riparian areas	c	Yes	Yes	Yes	Widespread in the mountains of the central Utah High Plateaus, the Wasatch Moutains, and the Uintah Moutains; fairly common in some areas
Botta's pocket gopher	all elevations	4,000-8,500	Occurs in many types of habitats and soils	c	Yes	Yes	Yes	Common and widespread in Utah
Northern pocket gopher	submontane /montane	5,000-14,500	Prefers deep, sandy soils, and high elevation prairies, meadows, and open forests	c	Yes	Yes	Yes	Widespread and abundant
Ord's kangaroo rat	desert /submontane	3,000-8,000	Grasslands, shrublands, and woodlands with sandy soils and sparse vegertation	c	Yes	Yes	Yes	Common and widespread in Utah below 7000 ft
Plains pocket mouse	desert /submontane	3,000-7,500	Open grassland or desert habitats with sandy soils	c	Yes	No	Possible	Eastern Utah
Great basin pocket mouse	desert /submontane	5,000-8,000	Arid grassland, sagebrush, and pinyon-juniper areas with sandy soils	c	Yes	No	Possible	Common in Utah, occurs in W and central part of the state
Bushy-tailed woodrat	desert /submontane	4,500-14,000	Rocky habitats (rocky outcrops), particularly at high elevations	c	Yes	Yes	Observed	Common and widespread in Utah
Desert woodrat	desert /submontane	4,500-7,000	Rocky slopes and desert areas with sparse vegetation	c	Yes	Borderline	Possible	Common in W Utah
Northern grasshopper mouse	desert /submontane	4,500-8,000	Grassland, desert, sagebrush, or pasture, with sandy soils and sparse vegetation	k	Unknown	Yes	Observed	Widespread in Utah
Brush mouse	desert /submontane	4,000-8,500	Rocky sites with heavy brush	c	Unknown	Yes	Yes	Common in central and E Utah
Canyon mouse	submontane	4,500-8,000	Arid rocky habitats, such as deserts	c	Yes	Yes	Yes	Common and widespread in Utah in suitable habitat
Deer mouse	all elevations	3,000-14,000	Dryland habitats ranging from deserts to grasslands to coniferous forests	c	Yes	Yes	Yes	Common and widespread in Utah
Pinyon mouse	submontane	4,000-8,500	Rocky terrain in pinyon-juniper, desert scrub, and	c	Yes	Yes	Yes	Scattered throughout Utah in suitable habitat

Small Mammal Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Relative Abundance[4]**	**County Record[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
			woodland habitats					
Western harvest mouse	desert /submontane	3,000-7,500	Dense vegetation near water; meadows, fields, weedy areas, grasslands	c	Yes	Yes	Yes	Widespread in Utah
Western jumping mouse	desert /submontane	6,500-11,000	Mountain meadows near streams or marshes	c	Yes	Yes	Yes	N and central Utah
Long-tailed vole	submontane /montane	3,500-14,000	Forests, mountain meadows, sagebrush, and riparian habitats	c	Yes	Yes	Yes	Common and widespread in Utah
Montane vole	submontane /montane	6,000-14,500	Meadows and fields in mountain valleys	c	Yes	Yes	Yes	Common and widespread in Utah
Meadow vole	all elevations	3,000-9,500	Variety of habitats ranging from dry open areas to marshes	c	Unknown	No	Possible	Fairly common in N Utah
Water vole	submontane /montane	Not mentioned	Prefer alpine and subalpine meadows near fast-moving, clear streams	c	Yes	Yes	Yes	Mountainous areas of N and central Utah
House mouse	all elevations	Not mentioned	Buildings and cultivated fields (weedy fields); usually associated with man	c	Unknown	Yes	Yes	Exotic, very common in some areas
Norway rat	all elevations	Not mentioned	Cities; near buildings, farms, dumps	c	Yes	Borderline	Possible	Exotic, common in many North American cities
Black rat	all elevations	Not mentioned	Associated with man; buildings or fields near buildings; seaports	c	Unknown	Borderline	Possible	Exotic, not common in Utah
Muskrat	desert /submontane	3,000-14,500	Marshes, ponds; shallow, relatively still water surrounded with dense vegetation	c	Unknown	Yes	Yes	Common and widespread in Utah
Beaver	all elevations	3,000-14,000	Depend upon permanent water sources within 1/4 mile of woodlands	c	Unknown	Yes	Observed	Fairly common in Utah
Porcupine	all elevations	3,000-14,500	Prefers coniferous or mixed forests; also riparian zones, deserts, shrublands	c	Yes	Yes	Observed	Common and widespread in Utah
Pika	montane	10,000-14,500	Rocky slopes above the treeline (talus slopes and rockslides)	l	Yes	Yes	Yes	8,000-11,000 ft in Utah, mostly 9,000-10,000 ft; limited distribution in Utah
Snowshoe hare	submontane /montane	8,000-11,500	Mountain coniferous forests interspersed with thickets of aspen, willow, or alder	c	Yes	Yes	Observed	

Small Mammal Species Potentially Occurring in the Muddy Analysis Area.

Species	Ecological Association[1]	Elevation Range (CO)[2]	Habitat[3]	Relative Abundance[4]	County Record[5]	Predicted Habitat[6]	Occurrence Expected[7]	Comments[8]
Black-tailed jackrabbit	desert /submontane	3,000-7,000	Open areas or brushlands of foothills, lower valleys, and desert areas	c	Yes	Yes	Observed	Most abundant and most commonly seen rabbit species in Utah
White-tailed jackrabbit	desert /submontane	4,000-14,500	Mountains statewide, also foothills and valleys in N Utah; mostly open areas	c	Yes	Yes	Observed	
Desert cottontail	desert /submontane	3,000-7,000	Often concentrate in brushy areas along streams or dry washes	c	Yes	Borderline	Possible	Widely distributed, generally below 6,000 ft
Mountain (Nuttall's) cottontail	submontane /montane	6,000-14,500	Thickets, loose rocks, and cliffs; brushy areas along streams or dry washes	c	Unknown	Yes	Observed	Widely distributed, generally above 6,000 ft

[1] From Dalton et al. 1990; desert = 3,700 to 5,800 ft., submontane = 5,500 to 8,500 ft., and montane = 6,500 to 12,700 ft. elevation.
[2] From Colorado GAP analysis website (CDOW 2001); elevation range in ft.
[3] Mostly based on narrative from UDWR web site (UCDC 2003) and also UDWR 1997 (for sensitive species), and Dalton et al. 1990 (for a few species).
[4] From Dalton et al. 1990; c = common, u = uncommon, l = limited, r = rare, k = not known to inhabit the Wasatch Plateau area, Not mentioned = species not mentioned in Dalton et al. 1990.
[5] From UDWR 1997, for sensitive species, and Durrant 1952 (Mammals of Utah); "unknown" if species was not mentioned in either publication or no records in Durrant (1952).
[6] Based on predicted habitat maps from UDWR web site (Utah Gap Anaylsis 1997).
[7] Based on the information presented in the other columns of the table or whether we observed that species in the field.
[8] From UDWR web site (UCDC 2003) and UDWR 1997 (for sensitive species).
* These bat species were observed during a 1997 survey conducted as part of the SUFCO and Dugout Mine's permit requirements (Perkins and Peterson 1997).

APPENDIX E. NON-GAME BIRDS

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.

Species	Ecological Association[1]	Elevation Range (CO)[2]	Habitat[3]	Seasonal Status[4]	Relative Abundance[5]	Predicted Habitat[6]	Occurrence Expected[7]	Comments[8]
Common loon	all elevations	3,000-9,000	Large bodies of open water	Tr	u	No	Possible	Uncommon migrant through Utah, rare in summer
Western grebe	all elevations	3,000-9,500	Lakes, marshes, coasts	Tr	o	Borderline	Possible	Fairly common breeder in N Utah; winters along W Coast
Clark's grebe	not mentioned	3,000-9,000	Lakes, marshes, coasts	Not mentioned	Not mentioned	Borderline	Possible	Fairly common breeder in N Utah; winters along W Coast
Horned grebe	all elevations	3,000-6,000	Marshes, lakes, ponds, coasts	Su	u	No	Possible	Uncommon but regular migrant through Utah in spring and fall
Eared grebe	all elevations	3,000-9,000	Shallow lakes and ponds with large macroinvertebrate communities; islands	Su	u	No	Possible	Most common grebe in Utah, regularly breeds throughout the state
Pied-billed grebe	all elevations	3,000-9,000	Riparian areas, shorelines, marshy wetlands	Su	c	Borderline	Possible	Can be found year-round in Utah but some individuals only stay through summer
American white pelican	all elevations	3,000-9,000	Reservoirs, large bodies of water	Tr	r	No	Possible	Breeding colonies in N Utah; statewide on reservoirs during spring, summer, fall
Double-crested cormorant	all elevations	3,000-9,000	Ocean coasts, bays, lakes, rivers, reservoirs	Tr	r	Borderline	Possible	Uncommon and localized breeder in N Utah, migrates throughout the state
Great blue heron	Desert /submontane	3,000-9,000	Shorelines of lakes and rivers, marshes	Su	u	Borderline	Possible	Most common heron in Utah, found statewide in appropriate habitat
Snowy egret	Desert /submontane	3,000-9,000	Marshes, lakes, coastlines	N/A	k	Borderline	Possible	common breeder in Utah, leaves the state before winter
Black-crowned night-heron	Desert /submontane	3,000-10,000	Wetland areas, marshes along lakes	Su	u	No	Possible	Common summer resident in Utah, sensitive to human disturbance and habitat loss

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
White-faced ibis	Desert /submontane	3,000-9,000	Marshy freshwater areas, swamps, ponds, rivers	Tr	r	Borderline	Possible	Largest nesting colony in marshes around Great Salt Lake, migratory
Turkey vulture	all elevations	3,000-9,000	Open habitats in both lowlands and mountains	Su	c	Yes	Observed	Present statewide during summer months, migrate S for winter
Osprey	all elevations	3,000-10,000	Rivers, lakes, and ocean coasts	Su	r	Yes	Possible	Rare summer resident at mountain lakes and along Green River, rare migrant
Cooper's hawk	all elevations	3,000-10,000	Coniferous and deciduous forests, riparian woodlands	Su	c	Yes	Observed	Fairly common statewide throughout the year, in appropriate habitat
Northern goshawk	Montane; all (winter)	3,000-11,500	Mature mountain forests (conifer/aspen), usually within 1/4 mile of water	Yl	u	Yes	Observed	Permanent resident throughout Utah, not common, declining
Sharp-shinned hawk	Submontane /montane	3,000-11,500	Forests and woodlands; heavy brush areas	Yl	u	Yes	Observed	Common statewide throughout the year
Red-tailed hawk	all elevations	3,000-13,500	Open country with scattered trees, edge of woodlands	Yl	c	Yes	Observed	Most common bird of prey in Utah, occurs statewide and year-round
Rough-legged hawk	desert /submontane	3,000-9,500	Grasslands, fields, marshes, sagebrush flats and other open habitats (in winter)	Wt	c	Yes	Yes	Fairly common in Utah during winter
Ferruginous hawk	desert /submontane	3,000-9,500	Grasslands and shrub steppes, edge of pinyon-juniper woodlands	Su	r	Yes	Possible	Absent from spotty locations within breeding range, such as central Utah
Swainson's hawk	all elevations	3,000-10,000	Shrub and grassland habitats, deserts, agricultural areas with scattered trees	Su	r	Yes	Possible	Statewide in summer, particularly at mid-elevations in W and N Utah; declining
Northern Harrier	all elevations	3,000-9,500	Open habitats such as marshes, fields, and grasslands	Su	c	Yes	Possible	Year-round resident of Utah
Golden eagle	all elevations	3,000-14,000	Open country, especially in mountainous regions; nests on cliffs or in trees	Yl	c	Yes	Observed	Quite common in Utah year-round
Bald eagle	all elevations	3,000-8,000	Coasts, rivers, lakes, or reservoirs, in open areas with available perching sites	Yl	e*	Borderline	Observed	Threatened in Utah, only 4 known nest sites as of 2000; more common in winter
Prairie falcon	all elevations	3,000-14,000	Open habitats (prairie, desert, alpine tundra) adjacent to cliffs	Yl	c	Yes	Observed	

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Peregrine falcon	all elevations	3,000-10,000	Open habitats from seacoasts to high mountains, open forests, cliffs, tall buildings	Yl	e*	Borderline	Observed	Still rare in Utah but more abundant in recent years
American kestrel	all elevations	3,000-10,000	Open or partly open habitats with scattered trees, also cultivated and urban areas	Su	c	Yes	Observed	Common statewide year-round
Merlin	desert	3,000-9,000	Nests in coniferous woodlands or wooded prairies, often near water; open habitats during non-breeding season	N/A	k	Yes	Possible	Uncommon migrant and wintering species in Utah, very rare in summer
American coot	all elevations	3,000-9,500	Ponds, lakes, marshes, rivers	Su	l	Borderline	Yes	Common throughout Utah year-round, somewhat less common in winter
Sora	desert /submontane	3,000-11,000	Freshwater wetlands, wet/flooded fields	Su	u	No	Observed	Common in proper habitat throughout Utah during summer, rare during winter
Virginia rail	desert /submontane	3,000-9,000	Freshwater or occasionally brackish marshes; also saltwater marshes in winter	Su	c	No	Possible	Common in proper habitat in Utah in summer, uncommon during other seasons
Sandhill crane	all elevations	3,000-10,000	Shallow wetlands, freshwater margins, also forages in open grasslands, meadows	Tr	u	Yes	Possible	Small scattered breeding populations in NE Utah, migrates through the state
Snowy plover	all elevations	3,000-6,000	Beaches, mudflats, saltflats, shorelines of rivers, lakes, ponds	Tr	r	No	Possible	Common in Utah, largest concentration is on Great Salt Lake, migratory
Mountain plover	all elevations	4,500-6,000	Disturbed semi-arid grasslands (typically shortgrass prairie), also shrubsteppe	Tr	r	No	No	Casual migrant, also breeds in Uintah County
Semi-palmated plover	all elevations	3,000-6,000	During migrations: mudflats, beaches, flooded fields, marshes; breeds on tundra	Tr	u	No	Possible	Uncommon migrant through Utah during spring and fall
Killdeer	all elevations	3,000-10,000	Fields, meadows, pastures, mudflats, freshwater margins	Su	c	Yes	Observed	Common year-round in Utah
American (lesser) golden-plover	all elevations	3,000-6,000	During migrations: lake shores, marshes; breeds on tundra	Tr	u	No	Possible	Uncommon spring and fall migrant through Utah
Black-bellied plover	all elevations	3,000-6,000	Lake shores in Utah during migrations; breeds on tundra	Tr	u	No	Possible	Uncommon but regular migrant through N Utah

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Black-necked stilt	all elevations	3,000-6,000	Along freshwater and alkaline lakes, marshes, mudflats, shallow ponds, wet fields	Su	c	Borderline	Possible	Breeds in Utah; breeding range spotty and localized; migratory
American avocet	all elevations	3,000-9,500	Shallow alkaline wetlands, ponds, mudflats of lakes and impoundments, estuaries	Su	c	Borderline	Possible	Breeds in Utah (mostly in N Utah); breeding range spotty and localized; migratory
Spotted sandpiper	all elevations	3,000-11,500	Rocky shorelines and marshy habitats, from sea level to alpine areas	Su	c	Yes	Observed	Common breeder in Utah; migratory
Sanderling	all elevations	3,000-6,000	Beaches, mudflats; breeds on arctic tundra	Tr	u	Borderline	Possible	Uncommon transient in Utah; occasionally, small numbers may remain for winter
Baird's sandpiper	all elevations	3,000-9,500	Mudflats, shallow water, beaches; breeds on tundra	Tr	u	No	Possible	Uncommon migrant through Utah
Western sandpiper	all elevations	3,000-8,000	Breeds on tundra (no info about habitat used in Utah during migrations)	Tr	c	Borderline	Possible	Common migrant through Utah
Pectoral sandpiper	all elevations	3,000-6,000	Wetlands, shallow water in marshes and at pond edges; breeds on tundra	Tr	u	No	Possible	Uncommon migrant statewide
Least sandpiper	all elevations	3,000-9,500	Lakeshores and pond edges; some stay in Utah over winter near warm springs	Tr	c	No	Possible	Common in Utah during migrations, some birds remain through the winter
Semi-palmated sandpiper	not mentioned	3,000-6,500	Forages at water edges and on floating vegetation; breeds on tundra	Not mentioned	Not mentioned	Borderline	Possible	Rare migrant through Utah
Solitary sandpiper	all elevations	3,000-8,000	Streams, woodland swamps and ponds; also drainage ditches, puddles of manure	Tr	u	No	Possible	Uncommon migrant throughout Utah
Willet	submontane /montane	3,000-8,200	Shorelines of marshes and lakes, mudflats, coastal beaches	Su	c	No	Possible	Common breeder in Utah; migrates out of the state for winter
Common snipe	all elevations	3,000-10,500	Wetlands; nests in wet grass habitats	Yl	c	Borderline	Possible	Occurs throughout the year in N Utah and in winter in S Utah
Short-billed dowitcher	desert /submontane	3,000-6,000	Shallow (salt)water with mud; breeds on tundra, wet meadows, forest bogs	Tr	u	No map	Possible	Rare transient in Utah

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Long-billed dowitcher	all elevations	3,000-9,500	Shallow water with mud, freshwater ponds; breeds on tundra, wet meadows	Su	c	No	Possible	Common transient in Utah
Marbled godwit	all elevations	3,000-9,500	Mud and alkali flats, shallow water; breeds in prairie wetlands, pastures, marshes	Tr	c	Borderline	Possible	Common migrant in N Utah
Long-billed curlew	all elevations	3,000-5,000	Uncultivated rangelands and pastures, grassy meadows, prairies	Su	r	Yes	No	Fairly common summer resident and migrant in Utah, esp. central and N valleys
Lesser yellowlegs	all elevations	3,000-9,000	Marshes, mudflats, edges of ponds; breeds in open forests, muskeg, tundra	Tr	c	Borderline	Possible	Common migrant through Utah
Greater yellowlegs	all elevations	3,000-9,500	Marshes, mudflats, lakes, ponds, flooded fields; breeds in muskeg, tundra, bogs	Tr	u	Borderline	Possible	Common migrant through Utah, rare in winter in SW corner of state
Red-necked phalarope	all elevations	3,000-9,000	Lacustine wetlands, open water of bays, lakes, ponds, ocean; breeds on tundra	Su	c	No	Possible	Common migrant in Utah, more common in fall than in spring
Wilson's phalarope	all elevations	3,000-9,500	Freshwater marshes, sloughs, wet meadows, islands; occasionally saline habitat	Su	c	No	Possible	Common in summer and during migrations; breeds in Utah
Herring gull	all elevations	3,000-6,000	Along coasts and near lakes, rivers, and landfills; breeds on tundra, coasts, islands	Tr	u	No	Possible	Regular migrant to Utah, winters near the Great Salt Lake
California gull	all elevations	3,000-10,000	Mudflats, marshes, irrigated fields, lakes; also dumps, cities, agricultural lands	Su	c	Borderline	Possible	Year-round resident in Utah, found primarily in northern counties
Ring-billed gull	all elevations	3,000-9,500	Beaches, estuaries, water bodies, fields, parking lots, garbage dumps	Wt	c	Borderline	Possible	Common winter resident in N Utah, occasional transient elsewhere in Utah
Bonaparte's gull	all elevations	3,000-6,000	Feeds in open water; breeds in open coniferous woodlands near ponds, lakes	Tr	u	No	Possible	Uncommon transient in Utah
Franklin's gull	all elevations	3,000-9,500	Breeds in prairie freshwater marshes, sloughs, marshy lakes; feeds in fields	Su	c	Yes	Possible	Breeds near Great Salt Lake, transient throughout Utah
Black tern	all elevations	3,000-8,500	Freshwater marshes, sloughs, wet meadows; nests in dense emergent vegetation	Su	c	No	Possible	Rare breeder in N Utah, migrates S for winter

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Caspian tern	all elevations	3,000-5,500	Large lakes, marshes, islands (in lakes and rivers), beaches, bays, coastal waters	Tr	r	No	No	Uncommon during summer in N Utah, where it occasionally breeds
Forster's tern	all elevations	3,000-8,500	Cattail and bullrush marshes along ponds, lakes, and sloughs; bays, sea coasts	Su	c	No	Possible	Common in summer in N Utah and as a migrant throughout the state
Common tern	all elevations	3,000-6,000	Lakes, bays, sea coasts; breeds on islands and coastal beaches	Tr	u	Borderline	Possible	Rare migrant through Utah, seemingly more common in fall than in spring
Yellow-billed cuckoo	desert /submontane	3,000-6,000	Riparian (cottonwood/willow) or open woodlands with dense undergrowth, parks	Su	r	No	No	Extremely rare breeder in lowland riparian habitats statewide
Barn owl	desert /submontane	3,000-6,000	Open and semi-open habitats, especially grassland, farmland, often near towns	Yl	u	Yes	Possible	Occurs in limited numbers in Utah
Northern saw-whet owl	submontane /montane	5,500-10,000	Dense conifer and mixed forests, wooded swamps, bogs, brushy areas	Yl	u	Yes	Observed	Moderately abundant year-round in Utah
Short-eared owl	desert	3,000-8,500	Open habitats: grasslands, shrublands, meadows, marshes, tundra	N/A	k	No	Observed	Uncommon breeder in the northern half of Utah, declining
Long-eared owl	all elevations	3,000-9,000	Woodlands bordered with open habitats, often near water; also parks, orchards	Yl	c	Yes	Observed	Throughout Utah; some birds migrate while others don't
Burrowing owl	desert /submontane	3,000-9,000	Open grasslands and prairies; also golf courses, airports, cemeteries; need burrows	Su	l	Yes	Possible	Uncommon breeder throughout the state in suitable habitat
Great horned owl	all elevations	3,000-11,500	Conifer or deciduous forests, woodlands, orchards, parks, wetlands, semidesert	Yl	c	Yes	Observed	Most widespread owl in North America
Northern pygmy-owl	submontane /montane	5,000-10,000	Woodland habitats; mixed conifer-deciduous and pine-oak forests	Yl	u	Yes	Observed	Statewide in Utah in forests and woodlands, uncommon
Flammulated owl	montane	6,000-10,000	Montane forests, especially ponderosa pine associations	Su	u	No	Observed	Occurs in mountain ranges throughout Utah, especially SW and N-central part
Western screech-owl	all elevations	3,000-9,000	Woodlands (especially oak and riparian), scrub, orchards, woodlots, urban areas	Yl	u	Yes	Possible	Fairly common resident in Utah

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Common nighthawk	all elevations	3,000-10,000	Open and semi-open habitats, such as grasslands, fields, open forests, towns	Su	c	Yes	Observed	Fairly common breeder throughout Utah
Common poorwill	submontane	3,000-9,000	Semi-arid and arid grasslands and shrublands, rocky canyons, open woodlands	Su	c	No	Observed	Common breeder throughout Utah
White-throated swift	desert /submontane	5,500-10,000	Rocky cliffs and canyons in mountainous areas, occasionally coastal sea cliffs	Su	c	Yes	Observed	Common breeder in Utah
Black swift	submontane /montane	7,500-14,000	Cliffs near waterfalls in mountainous areas, steep rocky canyons, also sea cliffs	Su	u	Borderline	Possible	Extremely rare in Utah
Black-chinned hummingbird	desert /submontane	3,000-7,000	Riparian and open woodlands, shrublands, parks and gardens, often in arid regions	Su	c	Yes	Observed	Common in Utah
Broad-tailed hummingbird	all elevations	3,000-11,000	Riparian areas, open woodlands, mountain forests near openings, brushy slopes	Su	c	Yes	Observed	Common in Utah, more common during migrations than summer
Rufous hummingbird	submontane /montane	5,500-12,000	Coniferous forests with adjacent meadows, thickets, brushy slopes	Su (Tr?)	c	Yes	Yes	Migrate through Utah in the fall
Calliope hummingbird	submontane /montane	5,500-8,500	Mountainous areas; open forests, meadows, and canyon, often along streams	Su	u	No	Possible	Uncommon summer resident in mountain areas throughout the state
Belted kingfisher	all elevations	3,000-9,000	Streams, lakes; particularly forested wetland areas near clear fishing waters	Yl	u	Yes	Possible	Occurs year-round in Utah
Northern flicker	all elevations	3,000-11,500	Open forest areas; nearly ubiquitous where nest sites and open ground occur	Yl	c	Yes	Observed	Abundant in Utah
Red-headed woodpecker	all elevations	3,000-5,500	Deciduous woodlands (esp. beech or oak), open areas with scattered trees, parks	Su	u	Not mentioned	No	Not mentioned on DWR website; coal tracts appear to be out of range
Downy woodpecker	all elevations	3,000-11,000	Deciduous, mixed, and riparian woodlands, esp. aspen forests; parks, orchards	Yl	c	Yes	Observed	Common resident throughout Utah
Three-toed woodpecker	submontane /montane	8,000-11,500	Coniferous or sometimes mixed forests, burnt tracts; in Utah: spruce-fir forests	Yl	c	Yes	Observed	Generally rare in Utah, generally found above 8,000 ft

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Hairy woodpecker	all elevations	3,000-11,500	Deciduous or coniferous forests, wooded swamps, orchards, towns, parks	Yl	c	Yes	Observed	Mainly in mountainous areas in Utah
Williamson's sapsucker	submontane /montane	5,500-11,000	Conifer (fir, lodgepole pine) and mixed aspen-conifer forests; also aspen groves	Su	r	Yes	Observed	Mainly in mountainous areas in the eastern 2/3 of Utah
Red-naped sapsucker	all elevations	3,000-11,500	Coniferous forests with aspen, montane riparian woodlands	Yl	c	Yes	Observed	Common in suitable habitat throughout the state
Olive-sided flycatcher	all elevations	3,000-11,500	Open coniferous and mixed forests with standing dead trees	Su	u	Yes	Observed	Moderately common in much of Utah
Western wood-pewee	all elevations	3,000-10,000	Coniferous and mixed forests, forest edges, riparian woodlands	Su	c	Yes	Observed	Common breeder in Utah
Cordilleran (western) flycatcher	all elevations	3,000-11,500	Deciduous and coniferous woodlands and forests, riparian areas	Su	c	Yes	Yes	Fairly common breeder in Utah
Hammond's flycatcher	montane	7,000-11,000	Mature coniferous and aspen forests (desert, scrublands, woodlands in winter)	Su	u	No	Possible	Fairly common in the high mountain forests of Utah during breeding season
Dusky flycatcher	submontane /montane	5,500-11,000	Open and semi-open areas with dense brush; open conifer forests, aspen, willows	Su	c	Yes	Yes	Common breeder in Utah
Willow flycatcher	all elevations	3,000-10,000	Low scrub, swamps, thickets, especially willows, groves of small trees near water	Su	c	Borderline	Possible	Common summer resident in Utah
Gray flycatcher	submontane	5,000-7,000	pinyon-juniper, sagebrush, desert shrublands, open pine-oak woodlands	Su	u	Yes	Observed	Widespread in Utah
Say's phoebe	desert /submontane	3,000-9,500	Open woodlands, farmlands, savannas, usually near water	Yl	c	Borderline	Possible	Common breeder in lowland areas throughout Utah; occasional visitor in winter
Ash-throated flycatcher	desert /submontane	3,000-9000	Scrub, chaparral, open and riparian woodlands, especially oak and pinyon-juniper	Su	c	Yes	Observed	Widespread in the summer; common in S and E Utah, less common in NW Utah
Eastern kingbird	desert /submontane	3,000-9,000	Open and riparian woodlands, forest edges, agricultural areas, urban parks	Su	c	No	Possible	Moderately common in N Utah during summer

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Western kingbird	desert /submontane	3,000-10,000	Open and semi-open habitats: deserts, grasslands, agricultural and riparian areas	Su	c	Yes	Observed	Common breeder throughout Utah
Cassin's kingbird	submontane /montane	4,500-7,000	Mixed deciduous-conifer woodlands, dry savanna, scrub; also riparian areas	Su	u	Borderline	Possible	Common summer resident in suitable habitat in southern Utah
Horned lark	desert/mont	3,000-9,000	Open habitats: desert, grasslands, agricultural areas, tundra, alpine meadows	Yl	c	Yes	Yes	Common permanent resident in Utah in suitable habitat
Cliff swallow	desert /submontane	3,000-10,000	Open areas near running water; nests on cliffs, bridges, buildings, or in culverts	Su	c	Yes	Observed	Common resident across the state of Utah
Barn swallow	desert /submontane	3,000-10,000	Open habitats, especially near water; nests on rafters, bridges, cliffs	Su	c	Borderline	Possible	Common breeder in Utah
Bank swallow	all elevations	3,000-8,000	Open country, especially near running water; nests along cliffs and bluffs	Su	c	No	Possible	Fairly common summer resident in lowland areas throughout Utah
Northern rough-winged swallow	desert /submontane	3,000-9,000	Open country, especially near water; nests in earthen banks along waterways	Su	c	No	Possible	Breeds in lower valleys throughout Utah
Tree swallow	all elevations	3,000-10,500	Open woodlands near water; coniferous forests in Utah; nests in tree cavities	Su	c	Yes	Observed	Common summer resident in N and central Utah; large flocks during migrations
Violet-green swallow	all elevations	3,000-13,000	Coniferous or deciduous open forests or woodlands, particularly aspen	Su	c	Yes	Observed	Common throughout Utah during summer; large flocks during migrations
Purple martin	montane	6,500-10,000	Open country, urban areas; in Utah: aspen-conifer forests near mountain lakes	Su	r	Yes	Possible	Rare during summer in mountains, more common during migrations in lowlands
Western scrub-jay	desert /submontane	5,000-7,000	Scrub oak, pinyon-juniper, brush, chaparral, pine-oak woodlands	Yl	c	Borderline	Observed	Common statewide
American crow	all elevations	3,000-10,000	Open habitats: agricultural areas, sparse woodlands, towns, orchards, tidal flats	Tr	o	Yes	Observed	Moderately common breeder in Utah, much more abundant in winter
Common raven	all elevations	5,000-14,000	Wide variety of habitats, often in mountainous or hilly areas	Yl	c	Yes	Observed	Abundant throughout Utah

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Steller's jay	montane; submontane (winter)	5,000-12,000	Coniferous and mixed forests, pine-oak woodlands	YI	c	Yes	Observed	Abundant in Utah
Pinyon jay	all elevations	5,000-7,000	Pinyon-juniper woodlands, pine woodlands	YI	c	Yes	Observed	Common in Utah
Gray jay	montane; submontane (winter)	5,000-11,500	Boreal and subalpine coniferous and mixed forests, open woodlands, bogs	YI	u	Yes	Observed	Common resident in S, central, and E Utah in suitable habitat
Clark's nutcracker	submontane /montane	5,500-12,000	Breeds in montane coniferous forests; also uses pinyon-juniper in winter	YI	c	Yes	Observed	Found in mountainous areas throughout Utah, at lower elevations in winter
Black-billed magpie	all elevations	3,000-13,000	Open country with scattered trees, brush, riparian and open woodlands, farmlands	YI	c	Yes	Observed	Commonly found in the valleys and foothills of N Utah
Black-capped chickadee	all elevations	3,000-9,000	Deciduous or mixed woodlands, riparian woodlands, thickets, parks, suburbs	YI	c	Yes	Observed	Common and widespread, found throughout the entire state
Mountain chickadee	all elevations	5,000-11,500	Montane coniferous forests; lower elevations in winter, including riparian areas	YI	c	Yes	Observed	Common permanent resident in Utah
Plain titmouse	submontane	5,000-7,000	Pinyon-juniper and oak woodlands	YI	u	Yes	Possible	Common and widespread in Utah
Bushtit	desert /submontane	5,000-8,500	Pinyon-juniper, oak scrub, chaparral, and other brushy habitats	YI	c	Yes	Yes	Common permanent resident throughout the state
Red-breasted nuthatch	montane	3,000-11,500	Montane coniferous and mixed forests, aspen; mature stands with decaying trees	YI	c	Yes	Observed	Uncommon permanent resident in Utah
White-breasted nuthatch	all elevations	3,000-11,500	Deciduous, mixed, and coniferous forests, riparian woodlands, pinyon-juniper	YI	c	Yes	Yes	Widespread permanent resident in Utah in suitable habitat
Pygmy nuthatch	montane	5,500-10,000	Pine forests (ponderosa pine in Utah, also yellow and Jeffrey)	YI	c	Yes	Yes	Common permanent resident in suitable habitat in S and E Utah
Brown creeper	all elevations	3,000-11,500	Forested areas in high mountains, pine forests; lower elevations in winter	YI	c	Yes	Observed	Moderately common year-round resident of Utah
Canyon wren	all elevations	5,000-8,500	Cliffs, steep rocky canyons, rock outcrops, buildings, in arid and semi-arid areas	YI	c	Yes	Observed	Fairly common year-round resident in Utah

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Marsh wren	desert /submontane	3,000-9,000	Fresh- and brackish-water marshes with abundant reeds	Su	l	Yes	Possible	Year-round resident in Utah
Rock wren	all elevations	3,000-12,000	Arid and semi-arid canyons, rock outcrops, talus slopes, scrublands, dry washes	Yl	c	Yes	Observed	Common summer residents in N Utah
Bewick's wren	desert /submontane	3,000-7,000	Open woodlands, shrublands, farms, suburbs; pinyon-juniper and deserts in Utah	Yl	c	Borderline	Possible	Permanent resident of S Utah, less common in winter; also breeds in NE Utah
House wren	all elevations	3,000-11,000	Open and semi-open brushy areas; open woodlands, shrublands, farmlands, suburbs	Su	c	Yes	Observed	Breeds in Utah, less common in winter
Winter wren	not mentioned	3,000-5,500	Forests (usually coniferous) or open habitats with dense brush or other groundcover	Not mentioned	Not mentioned	Yes	Possible	Moderately common winter resident but not a common breeder in Utah
American dipper	submontane /montane	5,000-11,500	Fast-flowing mountain streams	Yl	c	No	Observed	Moderately common in Utah
Blue-gray gnatcatcher	desert /submontane	5,000-7,000	Pinyon-juniper; deciduous forests, woodlands, swamps, scrub, chaparral, deserts	Su	c	No	Possible	Common summer resident in S Utah, less common in N Utah
Ruby-crowned kinglet	all elevations	3,000-11,500	Coniferous and mixed forests; mountains in summer, lower elevations in winter	Yl	c	Yes	Observed	Common year-round resident in Utah in suitable habitat
Golden-crowned kinglet	montane; submontane (winter)	3,000-11,500	Mountain coniferous forests in summer; lower elevation forests in winter	Yl	c	Yes	Yes	Uncommon year-round resident in Utah
Veery	desert /submontane	3,000-8,500	Shaded moist woodlands (esp. poplar, aspen) with understory	Su	u	Borderline	Possible	Rare summer resident in UT, breeds only on northernmost counties
Hermit thrush	submontane /montane	3,000-11,500	Conifer, mixed, and deciduous forests, forest edges, riparian areas	Su	c	Yes	Observed	Statewide summer resident, found year-round in Salt Lake Valley and SW Utah
Swainson's thrush	submontane /montane	3,000-11,000	Dense shrublands, woodlands, and riparian areas, coniferous forest edges, orchards	Su	c	Yes	Yes	Moderately common breeder in mountainous areas of Utah
Townsend's solitaire	all elevations	3,000-12,000	Open montane coniferous forests on steep rocky slopes; lower elevations in winter	Yl	c	Yes	Observed	Moderately common permanent resident throughout the state in suitable habitat

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Mountain bluebird	all elevations	3,000-13,500	Subalpine meadows, open forests and forest edges, rangelands, other open country	Yl	c	Yes	Observed	Breeds in high mountain valleys throughout the states; flocks during migrations
Western bluebird	all elevations	3,000-8,000	Open, riparian, burnt, or cutover woodlands, open country with scattered trees	Yl	r	No	Possible	Common year-round in central and S Utah mountains, usually above 7,000 ft
American robin	all elevations	3,000-11,500	Forests, woodlands, scrublands, wetlands, fields, parks, suburbs	Yl	c	Yes	Observed	Extremely common in Utah
Gray catbird	desert /submontane	3,000-7,000	Dense brush, shrublands, wooded suburbs, forest edges	Su	u	Borderline	Possible	Rare in Utah, breeding in a few limited areas of N-central Utah
Northern mockingbird	desert /submontane	3,000-7,000	Low open areas with scattered trees, farmlands, second growth areas, suburbs	Su	u	Borderline	Possible	In summer: common in S Utah, uncommon in N Utah; less common in winter
Sage thrasher	submontane	3,000-14,000	Sagebrush and greasewood communities in low-elevation deserts	Yl	c	Yes	Observed	Breeds throughout Utah in suitable habitat
American (water) pipit	all elevations	3,000-14,000	Alpine and arctic tundra; winters at lower elevations	Yl	c	Yes	Yes	Common in Utah year-round
Cedar waxwing	desert /submontane	3,000-8,500	Woodlands, forest edges, well-planted suburbs	Wt	c	No	Possible	Breeds in N Utah; flocks during migrations and winter
Bohemian waxwing	all elevations	3,000-10,500	Breeds in coniferous and mixed woodlands; often frequents suburbs in winter	Wt	u	Yes	Possible	Flocks may winter in Utah, depending on weather patterns and food availability
Northern shrike	desert /submontane	3,000-9,500	Open deciduous and coniferous woodlands, taiga, scrub, thickets	Wt	u	No	Possible	Rare migrant into or through Utah during winter
Loggerhead shrike	desert /submontane	3,000-9,000	Grasslands, pastures, fields with scattered trees, desert scrub, open woodlands	Yl	c	Yes	Yes	Common year-round resident of Utah
European starling	desert /submontane	not mentioned	Urban areas, farmlands, woodlands	Yl	c	Yes	Yes	Exotic, widespread
Warbling vireo	montane	3,000-10,500	Open deciduous and mixed woodlands, riparian woodlands, montane aspen	Su	c	Yes	Observed	Common summer resident in Utah

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Solitary vireo	all elevations	3,000-8,000	Montane coniferous and mixed forests (ponderosa, PJ, aspen), riparian woodlands	Su	c	Yes	Yes	Common breeder throughout Utah
Gray vireo	submontane	5,000-7,000	Pinyon-juniper on arid slopes in Utah; oak-juniper, arid thorn scrub, chaparral	N/A	k	Yes	Observed	Breeds locally in southern Utah
Yellow-rumped warbler	all elevations	3,000-11,000	Breeds in montane coniferous and mixed forests; lower elevations during migrations	Su	c	Yes	Observed	Common summer resident and migrant throughout Utah in suitable habitat
Magnolia warbler	montane	3,000-5,500	Open montane coniferous forests (spruce-fir-hemlock)	Tr	r	Not mentioned	No	Rare transient through southeastern Utah during spring and fall migrations
Black-throated gray warbler	submontane	3,000-7,500	Open, dry coniferous and mixed forests, pinyon-juniper, chaparral, scrub, oak	Yl (Su?)	c	Yes	Yes	Common summer resident statewide
Yellow warbler	all elevations	3,000-10,000	Woodlands, scrublands, agricultural areas, suburbs, riparian areas	Su	c	Yes	Observed	Abundant in Utah during spring and summer, migrates out of Utah for winter
Townsend's warbler	montane	3,000-12,000	Coniferous and mixed forests	Tr	u	Yes	Possible	Rare migrant through Utah in spring and fall
MacGillivray's warbler	all elevations	3,000-11,000	Dense riparian thickets (willow, alder), edges of coniferous or mixed forests	Su	c	Yes	Observed	Common throughout Utah during summer, nests at middle elevation
Orange-crowned warbler	all elevations	3,000-9,000	Deciduous and mixed woodlands, riparian thickets, chaparral	Su	c	Yes	Observed	Common breeder and migrant in Utah, rare in winter in SW Utah
Nashville warbler	all elevations	3,000-7,000	Open deciduous, mixed, coniferous, or riparian woodlands, thickets	Tr	u	No	Possible	Uncommon migrant through Utah
Virginia's warbler	desert /submontane	3,000-10,000	Brush on dry hillsides, pinyon-juniper, scrub oak, chaparral, mountain mahogany	Su	c	Yes	Yes	Common summer resident statewide
Wilson's warbler	all elevations	3,000-13,500	Riparian woodlands, thickets and brush near water (esp. willow and alder bogs)	Su	c	Yes	Yes	Uncommon breeder and common migrant in Utah
American redstart	desert /submontane	3,000-6,500	Open deciduous and mixed woodlands, forest edges, second growth, riparian areas	Tr	r	No	Possible	Rare summer resident in N Utah, rare transient in other parts of the state

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Common yellowthroat	submontane /montane	3,000-9,000	Marshes, riparian areas, brushy pastures, old fields, hedgerows, woodland margins	Su	l	No	Possible	Declining in Utah due to habitat loss
Yellow-breasted chat	all elevations	3,000-8,000	Dense brush or scrub, especially along streams and at swamp margins	Su	r	Yes	Possible	Fairly common breeder in Utah
Western tanager	all elevations	3,000-10,500	Breeds in conifer and mixed forests in mountains; riparian areas during migrations	Su	c	Yes	Observed	Breeds in the mountains of Utah; valleys during migrations
Lazuli bunting	all elevations	3,000-9,500	Arid brushy canyons, riparian thickets, chaparral, open woodlands	Su	c	Borderline	Possible	Common in summer throughout Utah
Indigo bunting	desert /submontane	3,000-5,500	Brushy and weedy habitats, deciduous forest edges and clearings, weedy fields	Su	u	No	No	Rare during summer in scattered locations throughout Utah, esp. SW corner
Rose-breasted grosbeak	all elevations	3,000-6,000	Deciduous forests and woodlands, second growth	Su	o	No	No	Rare migrant in Utah
Black-headed grosbeak	all elevations	3,000-11,500	Riparian woodlands and thickets, aspen, shrublands, open woodlands, pond edges	Su	c	Borderline	Observed	Common summer resident in Utah
Sage sparrow	desert /submontane	3,000-7,000	Shrublands (sagebrush, arid brushlands, chaparral), grasslands, deserts	Su	u	Borderline	Possible	Occurs locally throughout Utah in spring and summer, mostly SW Utah in winter
Black-throated sparrow	desert /submontane	3,000-6,000	Dry brushy habitat, desert scrub, rocky uplands	Su	u	Borderline	Possible	Breeds statewide, most commonly in the S part of the state
Lark sparrow	desert /submontane	3,000-9,000	Open habitats: grasslands, prairies, savannas, forest edges, cultivated areas	N/A	k	Yes	Possible	Common breeder throughout Utah; less common in winter (mostly S Utah)
Lincoln's sparrow	desert /submontane	3,000-12,000	Wet meadows, bogs, riparian thickets, mostly in mountains or boreal regions	Su	u	Borderline	Observed	Common breeder in mountains, common migrant, rare/uncommon in winter (SW)
Song sparrow	all elevations	3,000-10,500	Streamside thickets, marshes, wet meadows, bogs, forest edges, clearings, suburbs	Yl	c	No	Observed	Common year-round throughout Utah
Fox sparrow	all elevations	3,000-11,000	Forest undergrowth and edges, riparian thickets, scrub, montane	Su	u	Yes	Yes	Uncommon summer resident in N Utah;

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
			brushland					individuals migrate throughout the state
Vesper sparrow	all elevations	3,000-13,000	Dry grasslands and sagebrush, prairie, savanna, old fields, arid scrub, clearings	Su	c	Yes	Observed	Common in summer throughout Utah, rare in winter in SW Utah
American tree sparrow	desert /submontane	3,000-10,000	Open areas with scattered trees, brush, scrub; fields, marshes, suburbs in winter	Wt	u	Yes	Possible	Uncommon in winter in proper habitat
Brewer's sparrow	desert /submontane	3,000-10,000	Arid brushland, mostly shrub steppe (sagebrush), also high desert scrub	N/A	k	Yes	Observed	Common to very common in Utah (esp. NW) in summer; rare in winter (SW)
Chipping sparrow	all elevations	3,000-11,000	Open coniferous forests, forest edges, oak, pine-oak, streamside habitats, parks	Su	c	Yes	Observed	Common summer resident throughout Utah; one race breeds in the state
White-crowned sparrow	all elevations	3,000-13,000	Stunted woody vegetation, wet and alpine meadows, farmlands, parks, roadsides	Yl	c	Yes	Observed	Common in all seasons
Harris' sparrow	desert /submontane	3,000-6,000	Stunted trees in forest-tundra ecotone; in winter: thickets, woodlands, scrub	Wt	u	No map	Possible	Not common; rare winter visitor throughout Utah, especially SW
Lark bunting	desert /submontane	3,000-9,000	Shortgrass prairie, grasslands, meadows, sagebrush	Tr	o	No	Possible	Breeds in extreme NE Utah, migrates through the state
Dark-eyed junco	montane; all (winter)	3,000-10,000	Coniferous and deciduous forests and edges, open woodlands, brushy areas, bogs	Yl	c	Yes	Observed	Common year-round resident in Utah; some individuals do migrate
Green-tailed towhee	submontane /montane	3,000-11,500	Shrublands with interspersed conifers, pinyon-juniper, forest edges, riparian scrub	Su	c	Yes	Observed	Common breeder in NE Utah and in foothills and mountains throughout the state
Spotted (rufous-sided) towhee	desert /submontane	3,000-8,000	Brush, riparian thickets, dense shrubby areas, forest edges, chaparral, woodlands	Yl	c	Yes	Observed	Common throughout Utah on lower slopes of mountains, esp. in northern valleys
Red-winged blackbird	desert /submontane	3,000-11,000	Freshwater and brackish marshes, riparian habitats, brushy areas near water, fields	Yl	c	Borderline	Possible	Common year-round in Utah in suitable habitat
Rusty blackbird	submontane	3,000-5,500	Moist coniferous woodlands, bogs, riparian habitats	Tr	o	Not mentioned	No	Not mentioned on DWR website; transient

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.								
Species	**Ecological Association[1]**	**Elevation Range (CO)[2]**	**Habitat[3]**	**Seasonal Status[4]**	**Relative Abundance[5]**	**Predicted Habitat[6]**	**Occurrence Expected[7]**	**Comments[8]**
Brewer's blackbird	desert /submontane	3,000-12,000	Shrubby, brushy areas, riparian woodlands, aspen, marshes, farmlands, suburbs	Yl	c	Yes	Observed	Year-round resident in Utah
Yellow-headed blackbird	desert /submontane	3,000-8,500	Freshwater marshes, wetlands	Su	c	No	Possible	Common summer resident in suitable habitat throughout Utah
Bullock's (northern) oriole	desert /submontane	3,000-8,500	Open woodlands (cottonwood, willow, sycamore, oak), near fields or grasslands	Su	c	Borderline	Possible	Common breeder in Utah
Scott's oriole	submontane	3,000-5,500	Yucca, pinyon-juniper, oak scrub, riparian woodlands, palms, Joshua trees-cactus	N/A	k	Yes	Possible	Uncommon in summer, found mainly along Colorado River
Brown-headed cowbird	all elevations	3,000-12,000	Grasslands, prairies, fields, pastures, orchards, suburbs, woodlands, forest edges	Yl	c	Borderline	Observed	Common in summer throughout Utah, smaller numbers in winter, in SW corner
Western meadowlark	Desert	3,000-12,000	Grasslands, savannas, pastures, cultivated fields, mountain meadows, tidal flats	N/A	k	Yes	Observed	Mostly summer resident; some are permanent residents in lowland valleys
Common redpoll	all elevations	3,000-9,500	Subarctic coniferous forests, dwarf hardwoods, shrubby areas, tundra	Yl (Wt?)	c (r?)	No	Possible	Rare winter visitor in Utah
Pine siskin	submontane /montane	3,000-11,500	Coniferous and mixed forests, woodlands, parks, suburbs	Yl	c	Yes	Observed	Wanders widely, unpredictable; believed to occur statewide in all seasons
Lesser goldfinch	desert /submontane	5,000-8,000	Scrub oak, pinyon-juniper, open areas with scattered trees or brush, fields, suburbs	Yl	c	Yes	Yes	Statewide at mid to low elevations in summer, year-round resident in SW Utah
American goldfinch	desert /submontane	3,000-9,000	Weedy fields, open deciduous and riparian woodlands, suburbs	Yl	c	Yes	Observed	Found statewide at most times of the year but mostly breeds in N half of Utah
Cassin's finch	all elevations	5,500-11,000	Semi-arid open coniferous forests at higher elevations, ponderosa pine	Yl	c	Yes	Yes	Year-round resident statewide in high and mid-elevation forests
House finch	desert /submontane	3,000-10,000	Wide variety of habitats, arid scrub, open woodlands, urban areas, cultivated lands	Yl	c	Yes	Yes	Common year-round resident found statewide

Non-Game Bird Species Potentially Occurring in the Muddy Analysis Area.

Species	Ecological Association[1]	Elevation Range (CO)[2]	Habitat[3]	Seasonal Status[4]	Relative Abundance[5]	Predicted Habitat[6]	Occurrence Expected[7]	Comments[8]
Evening grosbeak	all elevations	5,500-10,000	Coniferous and mixed forests, second growth, parks	Wt	c	Yes	Observed	Uncommon in Utah during winter, may be rare breeder in mountains of NE Utah
Black rosy-finch	montane; all (winter)	5,500-11,500	Barren rocky or grassy areas on alpine tundra, maritime island tundra, rocky cliffs	Yl	u	Yes	Yes	Breeds in Utah mountains, especially Wasatch and Uinta
Grey-crowned rosy-finch	montane; all (winter)	5,500-11,500	Snowfields and rocky summits, alpine and maritime island tundra, rocky cliffs	Yl	u	Yes	Yes	Commonly found in Utah in summer (alpine areas) and winter (lower elevations)
Red crossbill	montane	6,000-11,000	Coniferous and mixed forests	Su	u	Yes	Yes	Moderately common in appropriate habitat throughout Utah
Pine grosbeak	montane; all (winter)	5,000-11,500	Open coniferous forests and forest edges	Yl	u	Borderline	Observed	Permanent resident at high elevations in the mountains throughout the state
House sparrow	desert /submontane	3,000-10,000	Human-modified habitats: agricultural, suburban, and urban areas; woodland edges	Yl	c	Yes	Possible	Exotic; permanent resident statewide in cities, towns, ranches

[1] From Dalton et al. 1990; desert = 3,700 to 5,800 ft., submontane = 5,500 to 8,500 ft., and montane = 6,500 to 12,700 ft. elevation.
[2] From Colorado GAP analysis website (CDOW 2001); elevation range in ft.
[3] Mostly based on narrative from UDWR web site (UCDC 2003) and on Ehrlich et al. 1988 (Birder's Handbook), also UDWR 1997 (for sensitive species), and Dalton et al. 1990 (for a few species).
[4] From Dalton et al. 1990; Tr = transient, Su = summer resident, Wt = winter resident, Yl = yearlong resident, N/A = not known to inhabit the area, Not mentioned = species not mentioned in Dalton et al. 1990; when this information was inconsistent with other sources, corrected information was added in parentheses with a question mark.
[5] From Dalton et al. 1990; c = common, u = uncommon, l = limited, r = rare, t = threatened, e = endangered (* The status of the bald eagle and peregrine falcon has changed since Dalton et al. published their study; the bald eagle is now listed as threatened and the peregrine falcon was delisted in 1999), o = occasional, k = not known to inhabit the Wasatch Plateau area, Not mentioned = species not mentioned in Dalton et al. 1990; when this information was inconsistent with other sources, corrected information was added in parentheses with a question mark.
[6] Based on predicted habitat maps from UDWR web site (Utah Gap Anaylsis 1997 and 1999).
[7] Based on the information presented in the other columns of this table or whether we observed that species in the field.
[8] From UDWR web site (UCDC 2003) and UDWR 1997 (for sensitive species).

APPENDIX 3-12

Mexican Spotted Owl Survey Muddy Tract

16292 N. Oachs Dr.
Surprise, AZ 85374
Phone: 623-933-8161
Fax: 623-933-8161
Email: jensenabs@cox.net
Cell: 602-527-9612

ARIZONA BIOLOGICAL SURVEYS

Mexican Spotted Owl Survey 2002 & 2003
Final Report

Work conducted by Lynn and Phil Jensen
of Arizona Biological Surveys

Abstract:

The "Coal Lease MSO Surveys" conducted in 2002 and 2003, consisted of 2 tracts. The two tracts surveyed were the North Horn and Muddy Coal Lease Tracts on the Ferron Ranger District of the Manti-LaSal National Forest. All areas were lumped as one survey area and are referred to as the "Coal Lease MSO Survey". The survey area was approximately 9,154 acres as estimated by the Forest Service. The area was surveyed according to the 1994 USFWS Mexican Spotted Owl Inventory Protocol. No spotted owl (Strix Occidentalis lucida) responses were detected in the survey area. Other species of owls detected were the great-horned owl (Bubo virginianus), and northern saw-whet owl (Aegolius acadicus). No nests were located for any owls. No other raptor species were detected.

Methods:

All work was conducted by Lynn Jensen and Phil Jensen. Both surveyors were trained in 1989, by Joe Ganey, of the Rocky Mountain Research Station, at Northern Arizona University. This training included field outings and instruction on protocol, forms, and identification. They conducted a season of survey for Mr. Ganey. Lynn Jensen worked for the Forest Service for the following four years and received MSO survey and monitoring training each year from the US Fish & Wildlife Service. Phil continued his work with spotted owls by assisting Lynn in formal monitoring activities. In 1995, Lynn began working as a private contractor, Arizona Biological Surveys, and obtained a USFWS take permit (#TE017942-0) for her company.

Survey areas were established by personnel of the Manti-LaSal National Forest. Survey routes were designed by Lynn Jensen and approved by Cara Staab, Wildlife Biologist at the Ferron Ranger District. All survey routes were designed in keeping with the 1994 survey protocol. All areas were covered using call points or continuous calling routes. Call points were typically placed 1/2 mile apart. Due to the rugged canyon terrain, a few calling points and routes were 3/4 mile apart. Complete coverage was obtained. All surveys were conducted during the night. Calling and record keeping followed survey protocol requirements. No recording or playback devices were used. Calling was by vocalization only. Four complete surveys were conducted in 2002 and four complete surveys were conducted in 2003. A Jeep was used to reach call points accessible by road. All other areas were reached on foot. Maps, compass, GPS unit, laptop computer, and MapTech© software were used to ensure accuracy of calling routes on the ground, and for reporting on maps and printing of maps.

Survey calling route:

Results per each survey:

2002	Survey #1	5-31-02 through 6-3-02	No raptor responses
	Survey #2	6-22-02 through 6-26-02	No raptor responses
	Survey #3	7-13-02 through 7-16-02	Great-horned Owl pair 120466720E 4312990N
	Survey #4	8-1-02 through 8-4-02	No raptor responses
2003	Survey #1	5-30-03 through 6-2-03	Northern Saw-whet Owl 120468712E 4320307N
			Northern Saw-whet Owl 120468419E 4319498N
			Northern Saw-whet Owl 120466132E 4313502N
	Survey #2	6-21-03 through 6-24-03	No raptor responses
	Survey #3	7-11-03 through 7-15-03	Northern Saw-whet Owl 120468691E 4320120N
	Survey #4	8-1-03 through 8-5-03	Great-horned Owl 120468366E 4319621N
			Northern Saw-whet Owl 120466519E 4313764N
			Great-horned Owl 120466278E 4313643N

Table of raptor responses (no spotted owl responses):

Problems or Recommendations:

Road conditions were generally very good. They were quite slippery after a rain, but dried quickly. The weather was generally good with the exception of the wind. Surveys were sometimes adjusted due to wind. For example, the surveyors moved to a different area where there was only a light breeze. Call point 1 at the north end of Clay Banks Swale, had significant water noise. It would be more effective to eliminate this call point. Call point 7, near the radio towers, was usually windy. The night had to be exceptionally calm to hear well.

Personnel Who Participated in Field Work:

Lynn Jensen
Phil Jensen

References Used:

Mexican Spotted Owl Regional Survey Protocol (1994 USFWS)

Birds of North America - A Guide to Field Identification, Golden Press, New York, 1983

Know Your Owls and Birds of Prey, Axia Wildlife International Inc. Software 1994

MapTech© Software - 1997 MapTech, Inc.

Number	Type	Topographic Map	UTM	Comments
1	Call point	Mahogany Point	120483228E 4346951N	Water noise very high
2	Call point	The Cap	120483457E 4337903N	
3	Call point	The Cap	120484366E 4337825N	
4	Call point	The Cap	120485107E 4338053N	
5	Call point	The Cap	120485520E 4338878N	
6	Call point	The Cap	120486504E 4339174N	
7	Call point	The Cap	120487373E 4339264N	Usually windy
8	Continuous call	Mahogany Point	120483489E 4345947N	
9	Call point	The Cap	120483640E 4343920N	
10	Call point	The Cap	120484317E 4343238N	
11	Continuous call	The Cap	120483423E 4334761N	
12	Call point	The Cap	120482351E 4336118N	
13	Continuous call	The Cap	120485741E 4335677N	
14	Continuous call	The Cap	120485881E 4337122N	
15	Continuous call	Flagstaff Peak	120472075E 4319911N	Start at old mine and walk out
16	Call point	Emery West	120471254E 4311957N	Old mine entrance
17	Call point	Emery West	120471287E 4312569N	

18	Call point	Emery West	120467765E 4311911N	Fan noise
19	Call point	Acord Lakes	120466948E 4312480N	Fan noise
20	Call point	Acord Lakes	120466745E 4313147N	Fan noise
21	Call point	Acord Lakes	120466424E 4314029N	Fan noise
22	Call point	Acord Lakes	120465732E 4314430N	
23	Call point	Acord Lakes	121465881E 4313656N	
24	Call point	Acord Lakes	120464988E 4313396N	
25	Call point	Acord Lakes	120464336E 4312584N	
26	Call point	Acord Lakes	120466538E 4311109N	Usually windy, fan noise
27	Call point	Acord Lakes	120465854E 4311731N	Usually windy, fan noise
28	Call point	Acord Lakes	120465675E 4312536N	Fan noise
29	Call point	Flagstaff Peak	120470606E 4319941N	
30	Continuous call	Flagstaff Peak	120469710E 4320210N	
31	Call point	Flagstaff Peak	120470141E 4318679N	
32	Call point	Flagstaff Peak	120468849E 4319847N	
33	Call point	Flagstaff Peak	120468355E 4318976N	
34	Call point	Heliotrope MT	120467283E 4319600N	
35	Call point	Heliotrope MT	120467378E 4321722N	
36	Call point	Flagstaff Peak	120468260E 4321241N	
37	Call point	Flagstaff Peak	120468486E 4320445N	
38	Call point	Flagstaff Peak	120469344E 4317672N	
39	Call point	Flagstaff Peak	120469325E 4316663N	
40	Call point	Emery West	120469352E 4315778N	
41	Call point	Emery West	120470195E 4315109N	
42	Continuous call	Flagstaff Peak	120470289E 4317452N	
43	Call point	Emery West	120472226E 4315884N	

Date	Geographic area	Species	Type of response	UTM	Nest located
7-14-02	Quitchupah Creek	Buvi	Adult/Audio	120466720E 4312990N	No
5-31-03	Greens Canyon	Aeac	Adult/Audio	120468712E 4320307N	No
5-31-03	Greens Canyon	Aeac	Adult/Audio	120468419R 4319498N	No
6-2-03	Quitchupah Creek	Aeac	Adult/Audio	120466132E 4313502N	No
7-12-03	Greens Canyon	Aeac	Adult/Audio	120468691E 4320120N	No
8-2-03	Greens Canyon	Buvi	Adult/Audio	120468366E 4319621N	No
8-3-03	Quitchupah Creek	Aeac	Adult/Audio	120466519E 4313764N	No
8-4-03	Quitchupah Creek	Buvi	Adult/Audio	120466278E 4313643N	No